In This Issue New Water Power Legislation

JOURNAL OF ELECTRICITY

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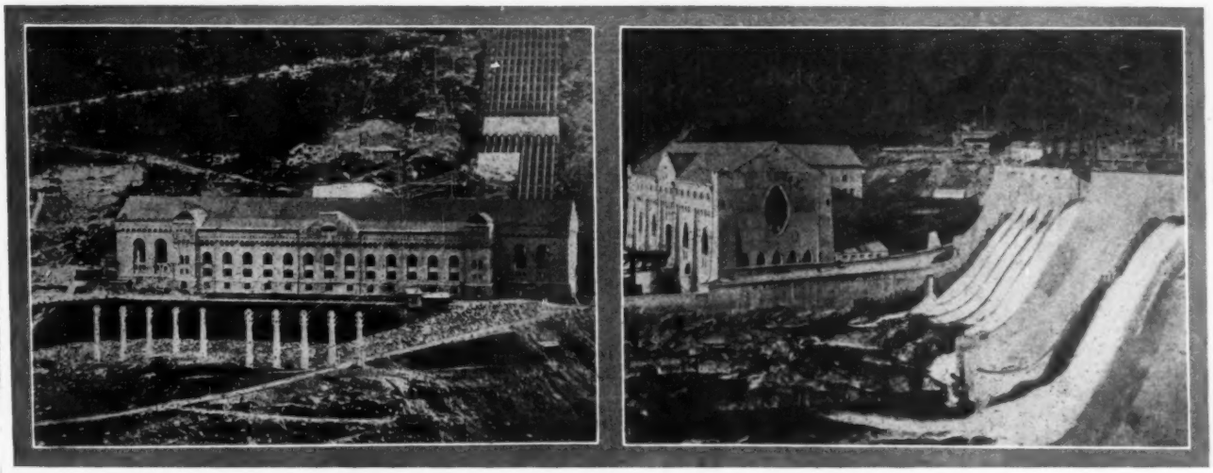

Here is how Norway develops vast water powers for the manufacture of nitrates. The absence of these industries in the United States, even before the war, compelled us to send abroad annually some thirty-two million dollars

The West is Prepared

With its ten million horsepower properly developed, the West could supply sufficient nitrates and other necessities in the manufacture of munitions of war to man the armies of the world. In times of peace these selfsame industries could furnish the fertilizers for replenishing the soils and immeasurably forwarding countless other industrial activities of the nation. When the cry is heard on all sides for conservation of fuel, it seems almost a sacrilege that these vast natural blessings should go undeveloped. Read the editorial comment in this issue on water power legislation now before congress.

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What Has Been Done in the West

Already the brave daring of engineers of the West has called into service over two-thirds of a billion dollars in electric power development and wonders have been wrought hitherto unaccomplished elsewhere in the whole world. In the eight states west of the Rocky Mountains there has been erected

The highest rock-fill dam.
The highest dirt-fill dam.
The highest dam of any type.
The longest span of aerial power lines.
The longest municipal tunnel for electric lines.
The longest submarine high power cable.
The largest single discharge turbine.
The longest system of municipal water supply.
The largest electrically operated gold dredge.
The greatest irrigation pumping project.
The second greatest system of impounded waters.
The first electrification of a transcontinental railroad.
The longest transmission system.
The largest system of hydroelectric distribution.
A host of the highest voltage long distance transmission systems.

THE EYES OF A NATION look to the West as the savior of the fuel situation and the West will not be found wanting.

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Devoted to the Generation, Distribution and Utilization of Energy

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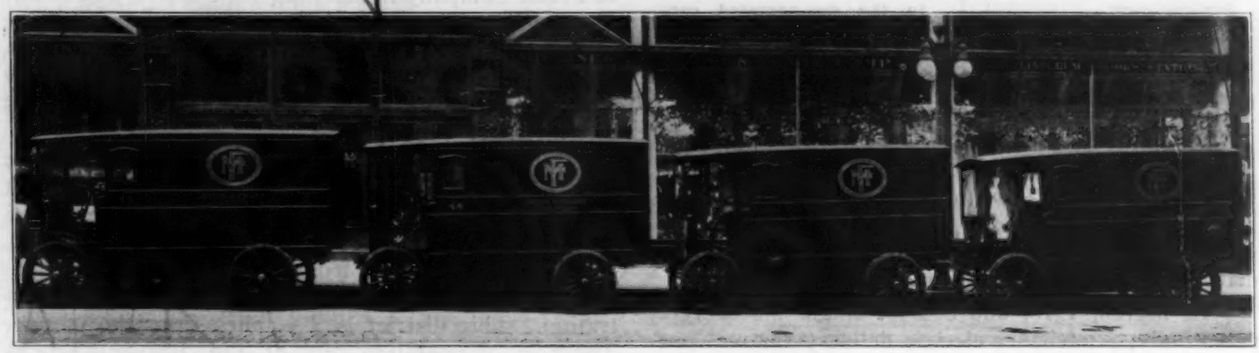


Group of Electric Trucks for Delivery Service in Portland

A SUCCESSFUL ELECTRIC TRUCK DELIVERY SERVICE

BY F. D. WEBER

(Electric truck delivery, as an economic factor in a large department store of the northwest, has come to stay. Here is an excellent article that tells how this wide-awake company was not content with the gas or electric car upon the market and as a consequence evolved its own particular type best suited to its needs. The electric service is proving a success in every particular and the low costs of delivery should commend its use to other similar institutions throughout the West. Since the electric charging load is a very desirable one from the central station viewpoint, the data given herewith should prove very helpful to central station managers.—The Editor.)

In 1910 the Meier & Frank Company, owners and operators of the largest department store in Portland, Oregon, had 62 horses and 30 wagons to carry its free delivery service. In order to determine whether the system then in vogue was "balanced" or could be improved, an extensive survey of the system was made. The method of collecting data is shown by the "Analysis Delivery Sheets" No. (1) and No. (2), which are copies of the blanks used for the survey.

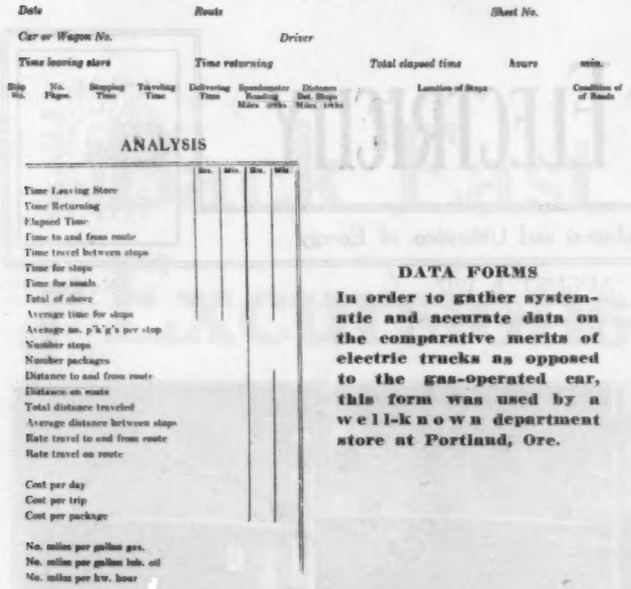
By means of this analysis the system was proven to be poorly "balanced" and a remedy found. Most of the drivers in the city districts were handling 4000 packages per month. Feeling that this was not what should be accomplished by the men, the system was speeded up. Immediately the men began to complain of being overworked, and in order to overcome this discontent a "Bonus System" was initiated on the following basis:

THE TYPICAL ONE TON ELECTRIC TRUCK

For the first 1000 packages in excess of 4000, that is 4000 to 5000 per month, the driver received 25 cents per hundred packages. From 5000 to 8500, a bonus of 50 cents per hundred packages, with a maximum of $20.00 bonus for any one month.

After this system was in operation a short time, the drivers no longer complained of being overworked and asked for larger districts. These same drivers at the present time are delivering 12,600 packages per month with two or three boys

Meier & Frank Co.,—Analysis Delivery Sheet



DATA FORMS

In order to gather systematic and accurate data on the comparative merits of electric trucks as opposed to the gas-operated car, this form was used by a well-known department store at Portland, Ore.

for helpers. During the month of March, 1917, twelve drivers received a bonus of from $4 to $20.

In March, 1910, one 800 lb. single motor type, panel body, Studebaker electric delivery car was purchased as was also one 1500 lb. electric car of the same type and manufacture. It must be remembered that the electric utility company did not promote the sale in any way, but that the Meier & Frank Company took the initiative itself. In May, 1910, two 1500 lb. double motor type, panel body Studebaker electric delivery cars were purchased and in November of the same year one 2000 lb. double motor type, panel body Studebaker electric delivery car, and one 2500 lb. furniture car of same manufacture and type were purchased. All these cars were equipped with Exide batteries and Westinghouse motors.

At the first the Meier & Frank Company did not have a charging set or maintain its own batteries but paid $40 per month per car for maintenance and charging service. This was a very disastrous experiment and extremely unsatisfactory.

In order to get satisfactory service and maintenance the Meier & Frank Company installed a charging plant of its own at a cost of $1500. This plant has proved highly satisfactory. The electric power is purchased for this plant at approximately 1½ cents per kw.-hr.

The charging plant is composed of one motor-generator set consisting of a 2300 volt, 60 cycle, 3-phase, induction motor, direct connected to a 600 amp. 130 volt, d.c. generator manufactured by the Westinghouse Electric & Manufacturing Company. There are enough charging panels provided so that all the machines can be charged at one time.

The electric cars which had been purchased up to this time were not specifically designed for the Meier & Frank Company's delivery service, consequently they were not thoroughly satisfactory. It was felt that an improvement upon their design could be made, hence the company undertook the building of 9 cars of its own design, in Portland, Oregon. These cars were called "Beaver Trucks." These trucks were all equipped with Edison batteries, General Electric motors and built with "panel bodies." They were all of the single motor type, and were constructed as follows:

During the year 1911, two 1500 lb. and one 4000 lb. furniture trucks, during the year 1912 two 1500 lb. trucks, and during the year 1913, four 2000 lb. trucks.

The size of bodies for these trucks was carefully determined from experience. The bodies of the Studebaker trucks contained 162 cu. ft. and were not sufficient, consequently the "Beaver Trucks" were increased to 192 cu. ft. This size has met the conditions exactly.

The following method is pursued by the Meier & Frank Company in handling their delivery business. The packages are carried in gasoline trucks from the store to the garage, which is a brick building 100 ft. by 100 ft., three stories in height. At this point they are distributed into bins corresponding to the various city districts.

The city of Portland, Oregon, covers 67 square miles, and has 325 miles of hard surface pavement (about ¼ of the street being paved). The trucks deliver over an area of approximately 150 square miles. This district is covered from one to seven times a day.

One of the typical districts is shown in the illustration. This district is 2½ miles from the garage. The cost of operating one of the Beaver Trucks during the year 1916, while delivering in this district, including the following items of cost, such as driver's salary, helper's salary, bonuses, repairs, electric current, oil, garaging, delivery overhead, insurance, depreciation, interest, taxes and miscellaneous, was as follows:

Cost of Delivery

Total cost per year	$3,125.56
Total number of packages delivered	85989
Cost per package delivered	3.6 cents
Total mileage covered	9129 miles
Greatest mileage covered in one month	760 miles
Total electric energy consumed during year	15600 kw.-hr.
Average cost per mile	1.7 cents
Total cost of electric current per year per car	$175.50

The maximum number of packages delivered in a day during the year, 700 with 463 stops and 32.8 miles traveled.

The same car has made as high as 57.8 miles, over the same route delivering 492 packages, with 328 stops with a maximum speed of 17 miles per hour. The radius of operation is 50 to 60 miles per charge. The number of cells used is 65. The cells are of the A6 Edison type. During the year no cells were broken and none were returned to the factory for repairs.

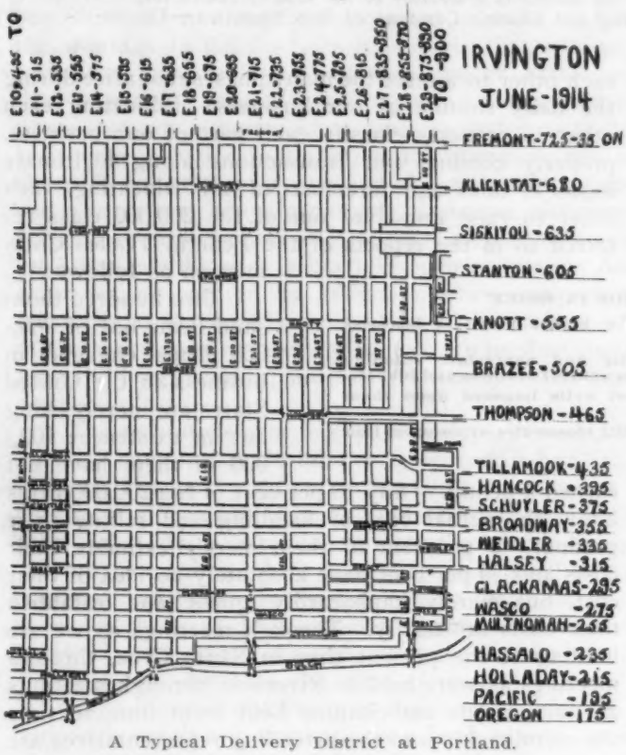
The regular crew on a truck is one driver and one helper, which may be increased to as many as three helpers. In the garage there is one day man and one night man for all the electric cars. The day man puts in part of his time on gasoline cars.

It is self evident that every delivery district has a different "package cost," depending on the distance from the garage, the size, road conditions and population.

The electric trucks have been entirely satisfactory and superior to the gasoline trucks, with one exception, and that is on muddy roads, where there is no pavement. The reason for this is that the electric trucks are limited in capacity. In other words, more energy can be carried in the gasoline tank of the gasoline truck than can be put in the storage battery of the electric. The electric can go through the mud just as well as the gasoline truck but lacks capacity.

Besides the trucks built by the Meier & Frank Company, there have been in the company's service over a dozen gas operated trucks of various designs and types, consequently an unusual opportunity for comparison has been offered.

The experience of the Meier & Frank Company is of great value as this company has approached the question of electric trucks with an open mind and has worked it out to its complete satisfaction.



A Typical Delivery District at Portland.

Actual operating costs kept with painstaking accuracy, have determined its final judgment in the matter. Consequently, it is safe to say that there is no other delivery system on the Pacific Coast as well "balanced" as that of the Meier & Frank Company of Portland. Oregon. Nor is there any delivery system where there is any more enthusiasm shown towards the electric truck.

RADIATION CORRECTION FOR THROTTLING CALORIMETER

In the issue of the Journal of Electricity for June 15, 1917, there appeared on page 498 a discussion of the steam calorimeter and its use in fuel oil practice. Due to considerable inquiry as to how the radiation correction is made for the throttling calorimeter the following instance is cited for the information of readers of the Journal:

In the determination of moisture content by means of the throttling calorimeter a definite loss due to radiation occurs. Also slight inaccuracies in thermometer calibration may exist. A correction factor may be determined in any particular test to cover all such discrepancies. This is done by allowing the steam in the boiler to become in a quiescent state. It is evident that in such a state of affairs the steam would be absolutely dry saturated, and may be considered as such for computation purposes. Hence by taking the boiler pressure we may obtain from the steam tables the total heat represented in each pound of steam passing through the calorimeter. Again by taking the lower pressure in the calorimeter and reading the superheat there found, the total heat of each pound of steam may be computed. If now this total heat is less than the former heat in the main, it is evident that a loss of heat must have taken place. In some instances, however, due to errors of thermometers, etc., the latter heat may appear larger than the former. In either case, however, a definite correction factor K is obtained whereby the calorimeter may be properly corrected in its readings for test conditions.

In order to thoroughly illustrate how the calorimeter correction factor is ascertained let us review the data taken for a calorimeter correction factor by Professor Joseph N. Le Conte in a test on the Townsend Street High Pressure Fire System of San Francisco.

Let us first return to equation (1) and now write an expression that will contain this factor K, and therefore set forth the true value of X_o. Since $(X_o L_o + h_o)$ is equal to $(H_s + K)$, evidently equation (1) now becomes

$$X_o = \frac{H_s + 0.47\,(t_s - t_3) + K - h_o}{L_o} = \frac{H_s + K - H_o}{L_o}$$

Hence we proceed with the consideration of the test data as follows:

Test Data

Boiler pressure = 179.6 lb. abs. = P_o.
Temp. of entering feed water = 188.1° F.
Capacity of boiler 83% overload for 4½ hours.
Thermometer reading at entrance to calorimeter = 375.0° F. = t_o.
Thermometer reading in calorimeter = 307.5° F. = t_s.
L_o for 375° F. = 849.1.
h_o for 375° F. = 347.6.
H_s for 307.5 = 1195.1.
Radiation factor = K.

Boiler in Quiescent State

Obs. No.	T	t_1	H	H_1	K
1	378	311	1197.4	1196.7	0.7
2	377	311	1197.2	1196.7	0.5
3	376	310	1197.0	1196.3	0.7
4	376	310	1197.0	1196.3	0.7
5	375	310	1196.8	1196.3	0.5
6	375	310	1196.8	1196.3	0.5
7	374	310	1196.6	1196.3	0.3
8	374	310	1196.6	1196.3	0.3

Average K = .52.

Then: $849.1\,X_o + 347.6 = 1195.1 + 52$ or $X_o = .9987$.
Hence, after applying the correction factor for the throttling calorimeter, the steam was found to be 99.87 per cent dry.

AMERICAN FIRM GETS BIG ARGENTINE CONTRACT

The second largest contract ever awarded by the Obras Sanitarias de la Nacion of Buenos Aires, Argentina, was obtained recently by an American firm. The United States Cast Iron Pipe & Foundry Company will supply 60,000 tons of pipe, amounting to about $3,500,000. The American commercial attache at London, England, was of assistance in bringing this contract to the United States. A report on the subject has been received from Secretary L. B. Clark, in charge of office of commercial attache, Buenos Aires.

DIVERSIFIED PROBLEMS OF CONTRACTOR AND DEALER

BY C. F. BUTTE

(Upon the proper solution of the diversified problems of the contractor and dealer depends much for the forward progress of the electrical industry as a whole. The recent convention of the California Electrical Contractors at Santa Cruz, Cal., was brim full of good things for the industry as a whole. Around this particular paper was grouped a noteworthy symposium of discussion in which representatives of the manufacturer, the jobber, the contractor, the dealer, and the central station took part. The result is that a clearer understanding and a healthier co-operative spirit is bound to exist among all branches of the industry in the future. The author is a member of the firm of contractors and manufacturers, known as the Butte Engineering and Electric Company of San Francisco.—The Editor.)

In the preparation of this paper covering the subject named, it will be my endeavor to treat analytically the various problems touched upon without drawing any specific conclusions, with the idea in mind that further discussions may materially aid and assist the drawing of correct conclusions and remedies for the many problems that should and must be corrected and solved.

SUGGESTED AIDS IN BRIEF

Educate contractor dealers to a higher plane in business method.

Contractor dealers must realize and appreciate valuable assistance offered them from central stations and jobbers.

Contractor dealers must correct evils imposed upon them by some concerns.

Contractor dealers must urge still closer ties of co-operation among themselves.

Should I attempt to fully cover and analyze each and every problem met by the electrical contractor and dealer, I fear that you would have to extend the period of our convention, therefore, I will merely touch lightly upon many of them, omit many for some future time and endeavor to dwell upon the present day problems of greatest importance to the industry as a whole. It will also be my endeavor to treat individually each problem taken up, in order that some means may be evolved whereby results can be obtained and not merely a general discussion.

The Riverside convention of the Pacific Coast Section N. E. L. A. has shown that a general discussion by the various allied interests is invaluable and we hope the central station, the manufacturer and the jobber will also enter into the discussion today; mainly keeping in mind that a solution or a suggestion helping towards a solution will be more valuable than a ramification of ideas or arguments. I want to repeat again that it is not my intention to draw any conclusions in this paper and I hope that each one will bring forth some discussion, some suggestion, some idea that may mutually benefit the industry and if any one idea has been brought out by this paper that will benefit the industry as a whole, I will have felt that the co-operative spirit shown at the Riverside convention by the central station, by the manufacturer and by the jobber has been embodied in the preparation of this paper.

Education.—The greatest problem before any association, whether it consists of electrical contractors, dealers, jobbers, manufacturers or central stations is the education of its members. Education not in the sense of an acedemic learning, not in the sense of technical knowledge, not in the sense of literary achievements, but in the sense of ordinary every day methods and processes of carrying on our business in a uniform, stable, economical, efficient and profitable manner. Educating each other to consider and study the many problems entering into the multitude of items that our business involves. Educating each other to foresee the many phases that arise during the daily routine of our business. Educating each other to properly classify each part of our business, properly conduct our transactions along legitimate business lines and foremost of all educating each other to raise ourselves out of the 200,000 class referred to in the reports of the Federal Trades Commission as follows:

Two hundred thousand firms out of 260,000 firms engaged in business in the United States are merely eking out an existence; 100,000 of them have not earned a penny. Only 10 per cent of the 200,000 firms know the actual cost of handling and selling their product, 40 per cent of them merely estimate their costs and 50 per cent have absolutely no idea of their cost, but merely haphazardly guess and establish their costs arbitrarily. Through meetings as we are holding at the present time in Santa Cruz, through meetings as were held at Riverside, through meetings as our various associations hold from time to time the membership and the attending representatives are rapidly gaining knowledge concerning their business affairs, rapidly elevating themselves out of the 200,000 class referred to before, but, how must we proceed to efficiently reach the firms and persons who do not take advantage of these meetings, how are we to promulgate the essentials of a successful business, how are we to cope with the 40 per cent and the 50 per cent class previously referred to in the Federal Trades Commission report, many of whom, will not, cannot and do not mend their ways, correct their own evils nor gain any knowledge from the experience of others without the knocks of bankruptcy falling upon their heads, incidentally of which there were 22,000 in the last year.

Will not some genius with an intuitive, initiative and instinctive mind help us to remedy this situation?

Estimating and Costs.—The purpose of conducting any business or project is to make a profit and the only way to make a profit is to sell something for more than it costs. Consequently the first essentials of any business house is to know the cost and that an accurate determination of cost is closely related to efficiency and proper business methods. Primarily costs consist of three elements, namely, material, labor and expense. In our contracting business, the first two elements, material and labor, must be determined by proper estimating methods whereby these two elements can be properly and correctly computed from

the plans and specifications. It appears that a proper, consistent, uniform and universal method for the computation of material quantities has not been formulated as yet and this question alone is broad enough to justify an individual discussion. Many times have we noted a wide variance in the quantity of material on the same plans and specifications in comparing the quantities given by various estimates. Why should this condition exist? Is it possible for one estimator to elongate the conduit to make up for the shortage in lengths? Is it possible that another estimator will carelessly compute longer distances than required? Is it a fact that some estimators use a two foot rule, others a linen tape line that invariably is incorrect, is it a fact that some estimators use a cheap 36 in. steel tape line and do other estimators use a rotometer which accurately measures distances either in a straight line or a curve, in order to compute the lengths of the conduit or wire runs? An error on the part of the estimator when computing distances in the first instances effects the entire cost of the contract as the same distances are used to compute the lengths and quantities of other essential materials.

The second element of cost, namely, labor cost, is also an item not uniformly or consistently handled. What is the best practice for handling this element? Is it most efficient to estimate the labor costs on a unit foot basis? Is it better to estimate the labor cost on the unit floor basis? Is it advisable to lump all items together and figure on the basis of so many days of labor for the job? Is it proper to figure the labor and material costs on the basis of outlets or circuits?

We now come to the third element "Expense." Although this element has been discussed continually, although continued emphasis has been placed upon the absolute necessity of including this element in cost, many careless, inexperienced, inefficient business men or rather unbusinesslike men, persist in disregarding this element. How can it be possible that any man will believe that the many items entering into this expense element are not a part of his cost for doing work? Essentially a proper method must be devised for handling this element and unless a contractor and dealer appreciates the existence of this element he will find that he has been operating under a gambling proposition and fortune sooner or later will be harsh with him. However, while he continues to disregard this element he is a disturbing factor in the industry and does injury not only to himself but to his fellow competitor. Oftimes have these items that constitute the third element of costs been recited, however, I would feel that I have been amiss in my duties if every opportunity is not grasped to repeat them again. Generally the third element of cost or overhead expense consists of the following:

Advertising.
Association dues and subscriptions.
Attorney fees.
Automobile maintenance and supplies.
Bad debts.
Commission not chargeable to jobs.
Clerical and bookkeeper's pay-rolls.
Defective work and repairs not chargeable.
Depreciation of stocks and equipment.
Drivers' pay-roll.
Executive expenses.
Entertainment expenses.
Freight, expressage and cartage not chargeable to jobs.
Interests and discounts.
Insurance.
Light, power and heat.
Office supplies.
Periodicals, newspapers and reports
Postage stamps.
Printing and stationery.
Preliminary expense on jobs not secured.
Rent.
Stockroom miscellaneous supplies.
Superintendence not chargeable.
Stock wastage and losses.
Stockroom pay-rolls.
Taxes.
Telephone.
Telegraph.
Rool repairs and losses.
Wagon repairs and maintenance.

The proper method for handling these various items in order that each and every contract carries the correct proportion or percentage of the third element must be devised. Again we have reached another item that will justify an individual discussion. First, how the third element of cost shall be computed; second, how the non-progressive business man can be made to realize the importance of this element, and third, how shall we proceed to educate the owners and architects that this item is a legitimate part of the cost of work and at what proportion to the total of the first and second element does the third element exist? Only by the determination of the proportion of the third element to the total of the first and second elements can we derive the actual cost of the work and only then can we talk profit, the reason for which we are in business and the only reason.

While I have spoken of the proportion of the third element to the total of the first and second elements of costs, it must always be borne in mind that the per cent of overhead expense is always based upon your gross annual business and never on your net cost of the first and second elements.

Will not someone carry these ideas further and enlighten us more on these vital elements, namely, first, material; second, labor; third, overhead expense and finally the only reasons for our being in business —profit.

Trade Discounts.—What is a trade discount? How many contractors have endeavored to solve the problem of obtaining orders from the consumers when the consumers can purchase electrical materials at the same price or nearly the same as an electrical firm. How many electrical contractors and dealers have solved the problem of obtaining orders from industrials who manufacture boilers and water heaters, who manufacture water wheels, who manufacture steam engines and tractors, who manufacture and fabricate steel bars and beams when these industrials extend their electrical equipment which in no way directly enters into their output? How many wholesale dry goods houses sell direct to the consumer at trade prices? How many wholesale shoe houses sell direct to consumers at wholesale prices?

Then why in the name of good business, sound reasoning or justification, should the electrical industry or rather the contractor dealer end of the business be pitted against such conditions? Why should not a trade discount be maintained? Do we see many electrical wholesalers with the sign "Wholesale Only" or "To the Trade Only" such as we daily see in any number of other lines of business? What must be done to make it possible for the contractor dealer to obtain the business he should have on his books? Is it the elimination of promiscuously extending trade discounts to the general users and consumers? Or, must the contractor dealer purchase his materials at a lower price in order to be in a position to obtain some of the existing business at the present prices?

Something must be done—something will be done

and something can be done. Cannot some one bring forth a solution for the conditions existing at the present time and mutually benefit the several branches of the industry? We know that the cost of manufacturing an article is practically a fixed quantity. We know the manufacturer has practically a fixed overhead charge in the operation of his plant? Do we know whether the manufacturer has a fixed cost for the selling of his product? Do we know whether the manufacturer is not duplicating to a great extent the same selling expenses that the jobber has to incur? Do we know whether the cost of placing a manufactured article in the hands of the contractor dealer is not excessive on account of the possible duplication of selling expenses? Should not the manufacturer eliminate some of his selling expenses and allow the jobber and dealer a greater margin between the fixed manufacturing costs and the price at which the consuming public will purchase the material and apparatus? Would it be possible to maintain the present industrial prices and the jobbers allow the dealers and contractors an additional discount over and above the present prices if the manufacturer would eliminate whatever duplicate selling expenses may exist? Do we not receive catalogues and literature covering identical materials both from the manufacturer and jobber? Do we not oftimes have visits from the manufacturer endeavoring to sell his product and then purchase the same product from the jobbers? Are there not many other ways by which the selling expenses are doubled? Why cannot the manufacturer eliminate these expenses and sell his product through the jobber without incurring duplicate overhead expenses, thereby cutting down the original costs and the ultimate price to the contractor-dealer; permitting the contractor dealer to obtain considerable more business at the present prices and at a reasonable margin of profit? Is there any reason why a solution is not possible?

Standardization.—Standardization is the keynote of success of any industry or undertaking. The application of standardization to the electrical industry has aided the manufacturer to produce higher grades of materials at correspondingly lower costs, has enabled the central station to utilize many of its resources to greater advantage, has assisted the contractor to undertake a greater volume of work without increased efforts, in fact one cannot point to any single instance wherein the application of standardization has not materially aided and benefitted the industry. The entire engineering ability of our country is now endeavoring to standardize all products and uniformly establish interchangeable parts. The automobile engineers and builders are endeavoring to standardize all parts of the automobile truck for use in the U. S. Army. The board of engineers of the United States are endeavoring to standardize the various parts of the steel merchant vessel our goverment intends to build and so on we hear and learn of the many industries standardizing their producers and output. What is the electrical contractor and dealer doing towards standardization? Can we not go further in the work than we have? Can we not standardize our method of estimating electrical work? Can we not standardize our method of construction? Can we not standardize materials and specifications and the many integral parts of our business?

Plans and Specifications.—How often do we come in contact with plans and specifications that are really complete in all essential details? How often must we practically lay out the entire work merely to estimate the requirements of the plans and specifications? Many present today can answer these two questions far better than the speaker and it appears to me that a wide field of good endeavor is open on this one subject. How many of you have ever seen a plan that shows the location of the service entrance or point to which the lighting and power feeders should be brought? Do we often receive plans and specifications that specify the sizes of feeders and sub-feeders? How about the plans that rarely show any branch circuit arrangement?

Do all really appreciate the amount of time and expense that would be saved to the many estimators if all plans were made to show the circuit runs, sizes of sub-feeds, size of feeders, location of lighting and power services? I would venture to estimate that 20 per cent of the entire collective estimating expense of the electrical contractor is expended in laying out information that should be originally shown on the plans. Bear in mind that each and every estimator must lay out the same work for the same job that they may be figuring and on the basis of six to eight bids on a job no further argument need be applied to prove that more complete plans are absolutely necessary. Aside from the time that may be saved, uniformity of construction and estimates will follow, when plans are really electrical plans. How can we bring this condition about?

Efficiency.—Following the lines of standardization and more complete plans and specifications we daily meet the problem of efficiency. Professor James Harvard after careful research states that the average man uses only 10 per cent of his mental ability and only 10 per cent of his physical power. Does it not follow a statement of this kind that we must apply our mental and physical power efficiently to accomplish what we aim to do? Are we carrying on our business affairs efficiently or can we gain further advantages if we watch ourselves more closely? Are not most failures due to man's mental and physical inefficiencies? Wherein can our industry gain by greater efficiency? I will willingly leave this subject open to you for further discussion and consideration with the fond hope that you will point out many ways whereby we can mutually gain.

Engineering Problems.—Under this heading I can hardly look upon any of the activities of a live contractor without drawing the conclusion that all of our problems dealing with our work would come under this heading. In my endeavors to cover this particular section I will practically begin with the first problems we meet and continue therefrom.

Engineering knowledge in the first sense is absolutely required to understand the fundamentals of the National Electric Code and to correctly interpret the requirements thereof. The interpretation of the

Code must be the guiding hand of any successful contractor, in view of the fact that all electrical installations and electrical materials must conform to the requirements thereof. The electrical code should be a Kent, Trautwine or Foster to the electrical contractor. The Industrial Accident Board's safety rules and the local ordinances pertaining to our work also contain many engineering problems in their interpretation.

The contractor must thoroughly understand plans, elevations and cross-sections, must thoroughly understand the many types and classes of building construction and also have knowledge of the processes of building construction work in order to correctly estimate his work, efficiently plan his operations and economically complete whatever contracts he undertakes. He must design and construct many pieces of apparatus and equipment to fulfill the requirements of his contract and oftimes apply his engineering knowledge and ingenuity to profitably complete the work in hand. The problems the contractor nowadays meets extend forty feet under the mud and 60 feet or more in the air. We undertake submarine work, we undertake underground work, we undertake aerial work and we undertake innumerable indoor installations. We undertake electric range work, signalling apparatus work, indoor and exterior illuminations, power and lighting generating installation, industrial and manufacturing equipments, power and lighting and telephone transmission installations, marine and steamship equipments, heating and furnace apparatus, and in fact I dare say very few applications of electricity exist the present day that a live, progressive and efficient electrical contractor does not meet in his daily endeavors, all of which require engineering knowledge and embody engineering problems. In addition to these problems he must also be a mighty good financial engineer to carry the many projects and undertakings to a successful conclusion.

He must be in a position to serve his customer well whenever he is called upon to give the costs of operation of an industrial plant, he must be able to talk intelligently on rates and consumption, he must be able to correct and remedy defects and damages that may have occurred, he must be able to recommend types and classes of apparatus and equipment most efficient and economical to perform the functions required, he must be able to argue load factors with the officials, he must be able to conduct himself intelligently in all matters pertaining to electricity.

The contractor must have some knowledge regarding the characteristics of metals, as many times he meets problems involving questions of conductivity, resistivity, magnetism, tensile and torsional stresses. He must understand at least elementary chemistry, as many classes of equipment involve chemical problems. In fact the present day demand made upon a progressive energetic electrical contractor requires a broad engineering knowledge to successfully and efficiently fulfill his place in the electrical industry.

Finally.—As I have previously stated I would not attempt to cover all the problems we meet in our branch of the industry and while I may have touched upon many of them, the number I have not touched upon will leave a great many subjects for future discussion.

However, in closing I wish to draw a few conclusions:

We must find some means whereby we can train and educate all contractor dealers to a higher plane in their business methods. We must find some means whereby we can make the contractor dealer realize and appreciate the valuable assistance and the possibilities of expansion that is offered to us by the central station and jobbers.

We must find some means whereby we can correct universally the evils imposed upon us by some concerns and finally we must energetically, effectively and persistently urge each and every non-member to join the California Association of Electrical Contractors and Dealers, become a part of the activities of the electrical industry, help to build up and expand the field of application and derive the benefits always forthcoming in any real live active and efficient electrical organization.

IS THE REGULATION OF PUBLIC UTILITIES A SUCCESS?

In an address brim-full of high and lofty ideals, E. K. Hall, vice-president of the Electric Bond & Share Company of New York expressed his views recently on the subject "Is the Regulation of Public Utilities a Success," and in summarizing his points, thus warned the three parties involved in this present day problem—the public, the utility and the commission:

In closing, I would say a word to each of the three parties to this regulation proposition. It is only by cooperation of the three parties that there is going to be success, and that success is both to the well-being of the companies and of the communities served. The companies must lay all of their cards on the table, and educate, educate, educate; get the facts out before everybody; go the limit, half way always and generally more than half way. The public should protect their commissioners; give them every kind of an opportunity to do their ob as they want to do it. Above all, make them independent.

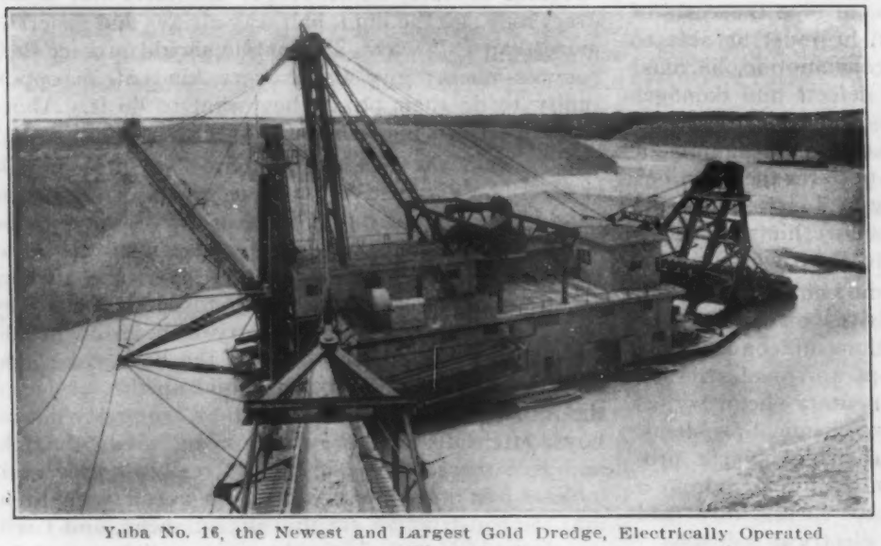
I would say just one final word to the commissions. The destructive, punitive period of regulation has just about gone by. The great constructive period is just about coming in. You have spanked the boys; you have spanked them hard; there are some of them a little bit sore; they are trying to do the best they know how; they are doing pretty well. How would it be if you should pat them on the back, take hold of their hands, and help them build up the service of the future? Tell the neighbors they are pretty decent boys, after all; that they are trying to do the job, and give the service, and it isn't really as easy as it looks. Join hands with them; go ahead with them into the constructive era that is just ahead, and I will guarantee you will enjoy the constructive period far more than you have the punitive period, and you will have more fun on the job than you ever had before, and 99 per cent of the public and all the companies will come in behind you and stand by you to the limit.

The Gold Dredging Fields of California

ELECTRICITY SUPREME IN GOLD DREDGING

Gold dredging has for some years been recognized as one of the substantial industries in which electricity plays a most important role. In the Journal of Electricity, July 11, 1916, appeared an article entitled "The Most Powerful Gold Dredge Afloat." This dredge is known as Yuba No. 15. But agreeable to the old adage, "The old king is dead, long live the new," the wonderful record of Yuba No. 15 has now been superseded by Yuba No. 16.

This new steel clad monster, electrically operated throughout, not only performs the function of washing the gold from the gravel, but also digs a channel and protects it by the construction of retaining walls. To make this possible it is built with two independent stackers, by which the waste material may be conveyed to the sides of the dredge, instead of behind it, as is usual. The illustration shown is taken from the end of one of the stackers. To gain an idea of the immense size of the machine, which cost over $600,000, it may be stated that it is 417 ft. to the end of the other stacker. Its 100 manganese steel buckets, each holding 18 cubic feet of gold-bearing gravel, dig 82 ft. under water. Three men operate the entire dredge, which digs and extracts the gold from 15,000 tons of gravel each day. The cost per ton for digging, extracting the gold, and stacking the waste, is only about three cents per ton. The total weight of the dredge is about 2500 tons.



Yuba No. 16, the Newest and Largest Gold Dredge, Electrically Operated Throughout

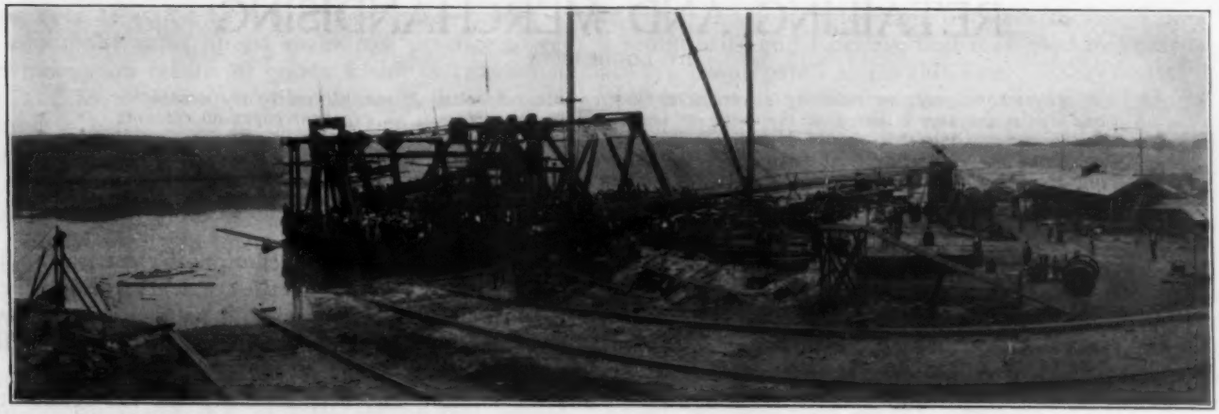
The electrical equipment is practically the same as that described for Yuba No. 15, in the Journal of Electricity Nov. 11, 1916. A total of nearly six hundred horsepower in installed motor capacity is necessary for its operation. The constant increasing uses of electrical energy in the gold dredging fields of California is a source of great satisfaction to men of the electrical industry.

The installation has been made by the Yuba Manufacturing Company which has its headquarters in San Francisco.

The Increasing Value of Liquid Credit Instruments

An extract from a general letter of the National Association of credit men is interesting at this time of necessary credit expansion:

No thoughtful student of conditions will fail to recognize that the flotation of large public loans made necessary by the exigencies of war is likely to cause pinch no matter how earnestly we strive for that equality of distribution which our organization is advocating. The need of large credits is now evident, and this may be supplied if there were available with business enterprises liquid credit instruments, and not open accounts which are valueless in times of pinch and can only be used, generally speaking, at high rates of interest if borrowed against.



showing the Yuba No. 16 Under Construction

NIGHT FREIGHT HAULING BY ELECTRIC RAILWAYS MAY LOWER COST OF LIVING

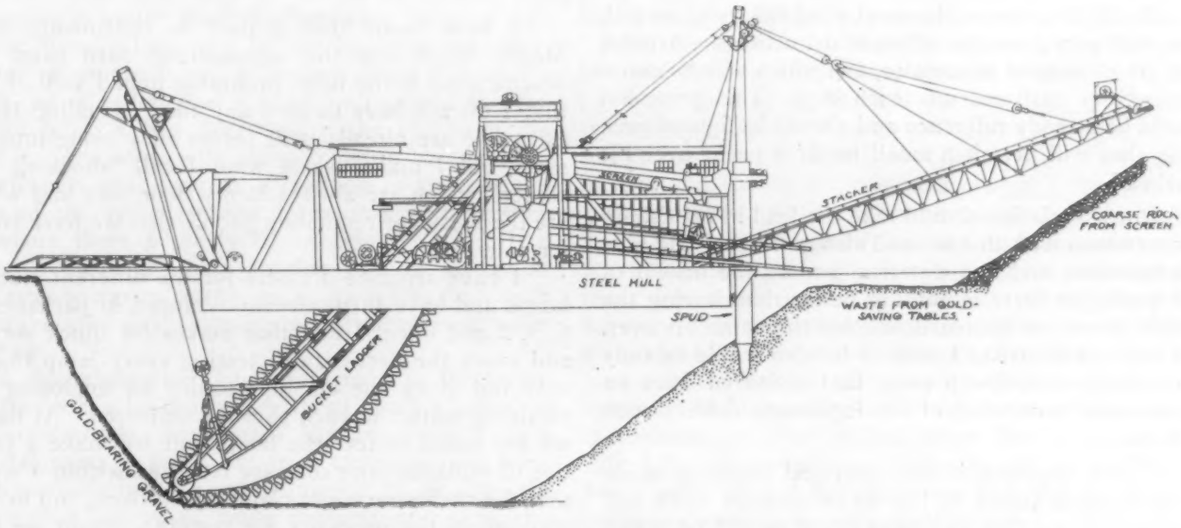
Night freight hauling by electric railways can be made a material factor in reducing the cost of living, according to Henry L. Doherty of the banking firm of Henry L. Doherty & Company, and he has instructed the managers of the various cities service traction properties to investigate the proposition as related to their local conditions.

Mr. Doherty recently returned from extended visits to Toledo, Kansas City and other middle west points, convinced of the feasibility of his plan. The primary move to make the idea a success, he thinks, would be the starting of an extensive educational advertising campaign in each city available, which would tend to show the public the benefits of the innovation, and consequently pave the way for legislation necessary to amend franchises not permitting this form of traffic.

Much of the high cost of living today is due to crudity in transportation methods, necessitating too much handling of each load, Mr. Doherty thinks. Two principal points involved are the hauling of food from the farm to the railroad, and its subsequent transport from the city terminal to the city buyer. Mr. Doherty uses potatoes as one example.

FUEL COSTS AFFECT PACIFIC LIGHT

The Pacific Light & Power Corporation, operating in Los Angeles and vicinity, for April and the four months ended April 30 reports increases in both gross and net earnings, compared with the same periods in 1916. Gross in April was $276,191, an increase of 7.96 per cent, and net $177,981, an increase of 3.45 per cent, with operating expenses up 17.22 per cent. The same tendency in earnings is reported for the four months and the increase in operating expenses is due to the unfavorable fuel situation existing around Los Angeles, where the shortage in both coal and oil has resulted in prices as much as double their normal quotations.



SECTIONAL VIEW, SHOWING THE PRINCIPLE OF OPERATION OF THE GOLD DREDGE

Here may be seen how the huge buckets of eighteen cubic foot capacity scoop up the gold bearing gravel, eighty-two feet under water, and dump it upon the revolving screen. This screen, washed by huge jets of water, deposits the worthless gravel upon the stackers, which convey it either to the rear or else for a retaining wall in the stream channel. The gold being very heavy, after passing through the screen, is caught by the mercury and riffles placed in the gold saving tables as the fine material is washed on down in its journey to the waste heap in the rear of the dredge. All equipment throughout is electrically operated.

RETAILING AND MERCHANDISING

BY LOUIS LEVY

(Better progress in retailing electrical appliances is a subject of prime interest to the contractor and dealer whether situated in the large or in the small city. Here is an excellent paper on retailing and merchandising that should prove unusually helpful to both these classes of men. The author is owner of the Levy Electric Company of San Francisco and sets forth in this paper many of the leading principles that have attained success for him in the electrical business world. The paper was read at the recent Santa Cruz convention of the California Association of Electrical Contractors and Dealers.—The Editor.)

It is a fact that most of us dealers, when starting in business, begin with a limited capital but with a practical experience which is necessary for the building up of an electrical contracting business. It seems natural that the construction end of an electrical business should be the bigger end and in my judgment, it will be quite a number of years before a merchant will consider investing for his own account any volume of money in a store and fittings for the sale of appliances unless he has had previous experience in the electrical business.

It may be that with the association work and the assistance of the jobber and central stations that we dealers will be put in a position to make sufficient money to create a better impression of the electrical business, but at the present time there is not sufficient volume nor sufficient profit to make the business worth while to business men looking for openings to go into business.

As conditions are now, the electrical dealers make a beginning in a small way as a repair man or contractor and with his stock more as a necessary adjunct to his contracting business than as a retail proposition. The fact that a store room must be rented and someone must answer the telephone, has been the temptation to have a place where goods might be sold at retail and to my way of thinking these beginners in the retail business, are the ones the association must encourage as much as possible.

To do this, one of the most vital things to furnish him with is a price list of standard articles. Articles that are household necessities, and which are the mainstay of our cash receipts each day. This price list should be a ready reference and should be figured on a basis that will permit a small buyer a profit over his overhead.

Our association should take the lead in furnishing our members with this list and also go further and give non-members and non-electrical houses the benefit of this work, for there is nothing better than having the re-sale prices on standard articles the same all over, and the non-electrical houses, I believe would be only too willing to follow a price that is issued from an organization composed of the legitimate dealers such as ours.

A new beginner in the electrical business needs every encouragement to join in association work and it seems to me that our association would be doing a good work, if every new man in the business was given a paid-up membership for six months or a year, so they could see for themselves the advantages of associating with us and learning from their competitors.

Inasmuch as every distributor of electrical appliances is of assistance to the central station, they in a spirit of co-operation should publish a list showing the different dealers and contractors who handle electrical goods,—if necessary, head the list with a line disclaiming any responsibility for the reliability of the different merchants named.

Merchandising of any goods requires capital, and capital for a new beginner is only acquired by saving, so it appears to me that a new beginner in the electrical business at the present time, is the exception when he starts in with capital sufficient to open up as a real retail merchant. All we can expect is for the average new beginner to learn by experience and when it comes to maintaining a clean store, bright show windows and up-to-date stocks, I believe that the association should maintain an expert whose business it would be to travel over the territory and make suggestions for the improvement of our establishments, and particularly the new beginners.

The foregoing remarks, I have made in the hope that the discussion which is to follow the reading of this paper will bring out the facts as to whether it is practical for us, with the assistance of the other interests of the business to put these ideas into practice.

I will now tell of some experiences in conducting my business which will apply more particularly to the small dealer whether he is located in a city or town.

I have found that it pays to continually show Mazda lamps and that considering turn over, the Mazda lamp is the most profitable item I sell. I find that I do not have to give any time to selling lamps as people are already sold before they come into the store, but I make use of what I call "shocking machines" which are always in my door way and which are the means of reminding people that we have lamps for sale.

I have separate drawers for the different sizes of lamps and have them already wrapped in packages of 6, 5, 2 and one. I find that makes for quick service and saves the necessity of testing every lamp that is sold and gives one an opportunity for enclosing advertising matter in each package delivered. At times, we are asked to test the lamps but we make a practice of replacing any that are returned within a week, that the customer might claim was broken, and in this way, avoid the necessity for testing. Again we find that people will order ½ dozen and if we stop to wrap them and they find that only 5 come in a box, they will change their order.

In replacing lamps which are claimed as defective, I find that it's the exception when we are imposed

upon and that it pays to replace quickly, any broken lamps, even though I have to stand the loss myself.

Along the same line, I make it a practice to refund money on return of goods within a reasonable time and as a closing argument on landing a sale, nothing is better than to offer to refund the money after a week's trial of the appliance.

You perhaps know that at the present time, my place of business is located in a residence section of the city and not down town. Mention is made to bring out the following facts I have tried my best to get general business from all over the city and have come to the conclusion that we must look for the best retail business within a radius of perhaps fifteen (15) blocks of the store and not expect to get any volume from elsewhere. While in 1916, I sold over $20,000 worth of goods at retail, I find that I am increasing business by concentrating my advertising and efforts to the neighborhood of the store.

For your information, I would say that in 1916 I tried to put out salesmen on house to house canvassing and spent considerable money for business this way. I have also spent money on printed matter advertising my own business and distributed in my neighborhood as against paying for the distribution of the advertising matter furnished by the National Advertisers. I believe this has paid, although the cost of doing this was so much that I could not afford to keep it up.

I might add here that I make use of the matter furnished by the National Advertisers, but always feel that I would like to see the day when the style of the matter furnished us will be changed so that our business will be given more space than the one inch or so that is allowed for our name and address.

My neighborhood has brought me considerable business in the way of repairing appliances, and I would like to bring out the fact that this is one part of the business that we can hold on to because we can handle it better than the hardware shop, grocer or drug store. This part of the business, however, requires prompt service. It means when a woman's iron is out of order, that it must be repaired at once and not left for two days before she can have the use of it. The same with the percolator, toaster, vacuum cleaner, etc. I am in a position to promise the return of the article within a reasonably short time and where there is likely to be delay, I make it a practice to loan the lady another iron or appliance. I always, however, agree on a price for the repair and never take any chances on a disagreement after repairing.

In this connection, I find that most of the standard articles can be repaired without much trouble, as the manufacturers have made the provision to have the extra parts in stock, but from experience we learn which manufacturer is not equipped to give us the service that our retail trade requires and it is this experience that we use in not boasting the sale of these particular appliances.

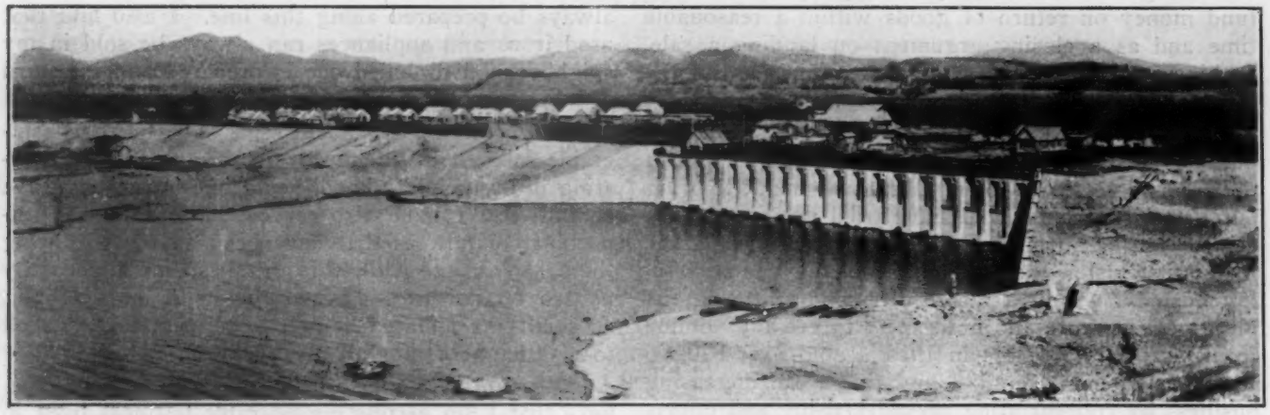
Another profitable part of the retailer's business, is the sale of used appliances and the rental of appliances. I made it a rule to have a rental price on everything that one would want to rent. Necessarily, the charge is sometimes high, but nevertheless, I have a rental price and I believe that it is good business to always be prepared along this line. I also find that used irons and appliances can always be sold in my neighborhood provided one is prepared and informed of what can be procured.

In furthering my business, I have taken considerable interest in an improvement club that is operating in my neighborhood, being one of the executive committee. I have also served on most of the important committees that have been appointed during the past year and while this all takes time, it certainly pays a retailer to get acquainted with his neighbor, especially as I stated before, I feel that I must look to my neighbors for all my business.

I would also like to bring out the fact that I believe that I am getting considerable business from so called industrials in my neighborhood because I can give them better service than they can get from the jobbers who have been getting most of their business. I do not hesitate to tell these people that I cannot compete on price but I manage to give them retail service which they are apparently willing to pay for up to a certain limit. I would state, however, that this business at the present time, is not secured at the full retail price. In handling this business, I do not employ any outside salesmen, depending on business coming into the store, and occasionally sending out circular letters to a selected list.

I have found that charge accounts pay and also that it does not pay to question too closely, the opening of new accounts. I have records to show that my losses from bad accounts averages 1½ per cent and from the best sources of information, this ratio of loss is reasonable. The average sales to customers will not be over three a year, and the expense of investigating the credit standing of a customer is out of proportion considering the profit on the account, so that I am very liberal in extending credit. Of course, I have some accounts that have been buying of me for over ten years and there never is a question as to payment, then again, there is the transient apartment tenant that expects to pay cash for everything, but might buy on the installment plan, if it were suggested, and this is the customer that it pays to take a chance with.

All in all, I believe that our retail business opportunities are getting better and better and that if there were more dealers in it, concentrating on retailing only, that the public would patronize the specialty shop more and more and that in time, with the increase in the number of specialty electric shops, the hardware shop, grocery and drug stores will find that it does not pay them to handle our line of goods. By this, I do not mean that the goods will be bought at lower price from specialty shops, but that by honest and conscientious business dealings, and a more thorough knowledge of our business, the electrical retailer ought to, and will be able not only to hold his own, but forge ahead so that in time, the main retail sections of all towns and cities will have retail electrical stores.



The Jackson Lake Dam of the Minidoka Project

PUMPING PLANTS OF THE U.S. RECLAMATION SERVICE

BY S. T. HARDING.

(Unit costs for electrical pumping are of vital importance in economic application of electrical energy to the great arid districts of the West. Seldom has this information been available for comparative study. Here is an excellent article on comparative costs of raising one acre foot of water through a height of one foot, compiled from the exhaustive records of the U. S. Reclamation Service. The author is a well-known irrigation investigator in the faculty at the University of California, who formerly was an engineer in the Reclamation Service.—The Editor.)

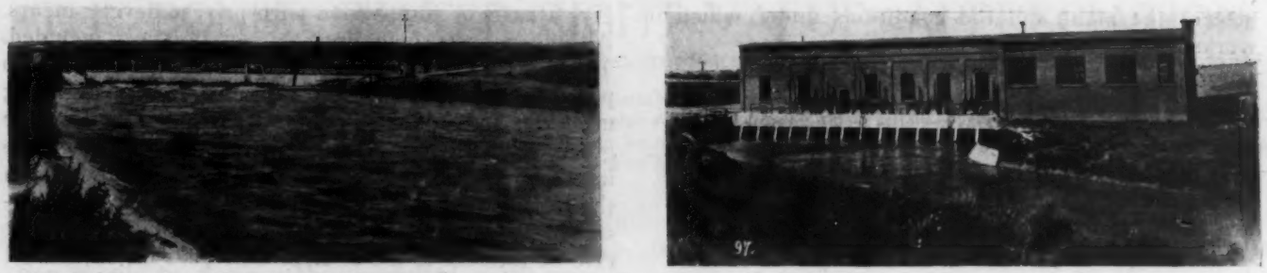
Records of the operation of pumping plants for irrigation are not generally kept in such form as to enable the unit costs to be determined. Many such pumping plants keep records of expenditures but few also keep records of the quantities of water pumped and the lifts. Unit costs for pumping are more conveniently expressed in terms of the cost of raising one acre foot of water through a height of one foot or per foot acre foot.

In the recently issued Fifteenth Annual Report of the U. S. Reclamation Service information regarding the costs and operation results with a number of plants for the year 1915-16 is given from which the following discussion has been prepared. The general data are assembled in Table 1.

Interior View of Minidoka Pumping Station No. 2

On the Salt River project the pumps are operated by electric power generated by the power plants of the Reclamation Service. These pumping plants, except the High Line are used to augment the gravity supply from wells. Each unit consists of a battery of 3 wells located in a straight line 30 ft. apart except battery A where the wells are 25 ft. apart. These units develop approximately 10 second feet each except Battery A which has developed but 8 second feet.

On the Minidoka project the first, second and third lifts are used on the south side pumping unit which supplies a total of about 50,000 acres. In 1914 the runners in the pumps were replaced and some slight changes made in the diffusion vanes at a cost of less than $1500



Forebay and Discharge, Pumping Station No. 1 of the Minidoka Project

per unit which increased the capacity approximately 30 per cent. The stations now have a capacity of 732, 617 and 433 second feet for each lift respectively. The power is generated at the diversion dam on the Snake River, the water which must be let pass for rights lower on the river being used under a head of 46 ft. The actual cost of operating and maintaining the power house and transmission lines exclusive of interest charges was less than $3 per horsepower per year. This represents the cost of delivering a very large block of power at high voltage and should not be confused with the cost of delivering in retail quantities.

The remaining plants on the Minidoka project are used to irrigate areas too high for gravity service. The A4 plant is of the scoop wheel type.

The pumping plants on the Huntley and Yakima projects utilize the power secured from a fall in the canals to lift a portion of the water to higher levels. On the Huntley project a drop of 34 ft. in the main canal develops power to pump 56 second feet into a canal 46 ft. above the main canal. Each unit consists of a 20 in. centrifugal pump mounted on the same shaft with the vertical turbine which drives it. Operation is practically automatic. On the Yakima project the Snipes Mountain plant consists of one 12 in. 2-stage and one 8 in. single stage turbine centrifugal dump direct connected to turbines of 360 and 148 h.p. respectively. The drive head is 64 ft. and the delivery head 190 ft. The Hillcrest plant consists of one four-stage vertical direct connected turbine centrifugal pump unit. The drive head is 32 ft. and the delivery head 112 ft.

The two plants on the Yuma project are gas engine driven. The Reservation Drainage plant is used to discharge drainage water over the levee, its operation being intermittent. The Yuma Valley plant is a temporary installation assembled from used equipment on hand, a new unit being contemplated when the requirements of use have been more definitely determined. The high costs are due to the low lifts and nature of the service.

A number of the columns in the table have been derived from the data as given in the published report. In the operation of such power developments, the cost of operation and maintenance of the power house and transmission lines is distributed to the various users of the power developed. The cost of power for these plants is generally low as it is developed at sites made available by the irrigation development as on the Minidoka project. The form used for compiling the costs of the operation and maintenance of the pumping plants is shown in Fig. 1. (Use form 7-326 of Use Book of June, 1914). The costs given in the table are the totals as shown by such reports for the year. These costs do not include interest on the investment.

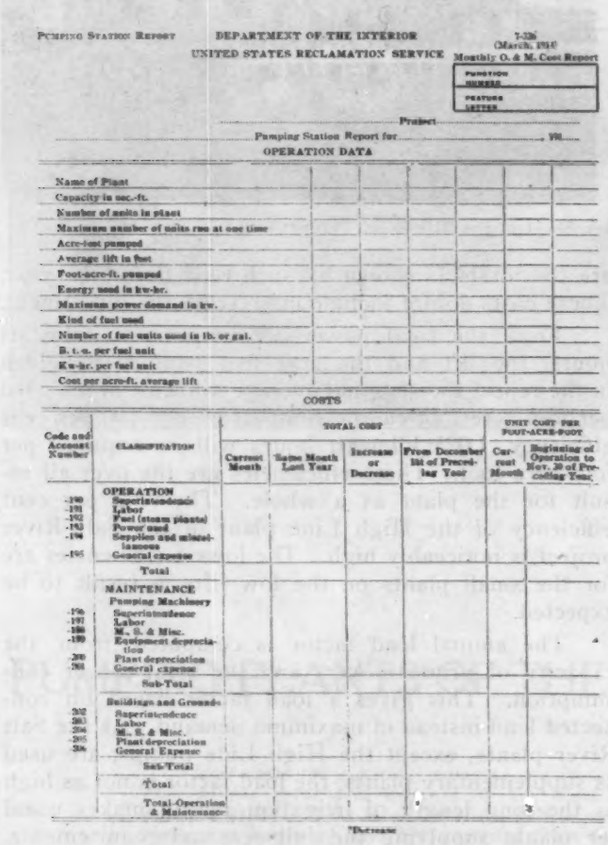
From the total power consumption in kilowatt hours, the lift and the acre feet pumped as given in the report the seasonal average kilowatt hours used per foot acre foot can be computed. For 100 per cent efficiency, 1.025 kilowatt hours will be required per foot acre foot. These efficiencies are the over all result for the plant as a whole. The 73.2 per cent efficiency of the High Line plant of the Salt River project is noticeably high. The lowest efficiencies are for the small plants on the low lifts, a result to be expected.

The annual load factor is computed from the capacity of prime movers and the total power consumption. This gives a load factor based on connected load instead of maximum demand. As the Salt River plants, except the High Line pumps, are used as supplementary plants, the load factor is not as high as the long length of irrigation season makes usual for plants supplying the full seasonal requirements. The High Line plant represents a very favorable power load. The load factors on the larger plants on the Minidoka project also are quite high when the shorter irrigation season is taken into consideration.

The total costs of pumping plants in terms of both horsepower of prime movers and of second feet of capacity are computed for those plants for which the data is given. These show a wide variation as is to be expected. The plants pumping from wells on the Salt River project have cost about $250 per horsepower or $2000 per second foot of capacity. These costs include the cost of the wells. The large units on the Minidoka project show the much lower costs which are possible with plants of this character. The three plants will serve a total area of about 50,000 acres or a total cost for the pumping plants alone of about $10 per acre. The costs of direct connected turbine and pump plants vary with the size but are lower than for well plants. The costs for the Yuma pump are not typical as they are temporary units assembled from available equipment.

The cost of operation varies widely due to the varying cost of power, efficiency of the plant and the load factor. The highest unit costs are for those plants operating on low factors or low lifts. The very low costs for plants operating at drops is very noticeable and emphasizes the relative economy of such developments. Water is lifted 197 ft. on the Snipes Mountain plant for about the same operation cost as it can be lifted from wells with about one-fourth the lift on the Salt River project, the difference being due to the

size of the plant and the conditions under which it works.



PUMPING STATION REPORT — DEPARTMENT OF THE INTERIOR — UNITED STATES RECLAMATION SERVICE — 7-326 (March, 1914) — Monthly O. & M. Cost Report

FUNCTION NUMBER — FEATURE LETTER

Project

Pumping Station Report for ..... 19..

OPERATION DATA

Name of Plant								
Capacity in sec.-ft.								
Number of units in plant								
Maximum number of units run at one time								
Acre-feet pumped								
Average lift in feet								
Foot-acre-ft. pumped								
Energy used in kw-hr.								
Maximum power demand in kw.								
Kind of fuel used								
Number of fuel units used in lb. or gal.								
B. t. u. per fuel unit								
Kw-hr. per fuel unit								
Cost per acre-ft. average lift								

COSTS

Code and Account Number	CLASSIFICATION	TOTAL COST				UNIT COST PER FOOT-ACRE-FOOT	
		Current Month	Same Month Last Year	Increase or Decrease	From December 1st of Preceding Year	Current Month	Beginning of Operation to Nov. 30 of Preceding Year
	OPERATION						
-190	Superintendence						
-191	Labor						
-192	Fuel (steam plants)						
-193	Power used						
-194	Supplies and miscellaneous						
-195	General expense						
	Total						
	MAINTENANCE						
	Pumping Machinery						
-196	Superintendence						
-197	Labor						
-198	M., S. & Misc.						
-199	Equipment depreciation						
-200	Plant depreciation						
-201	General expense						
	Sub-Total						
	Buildings and Grounds						
-202	Superintendence						
-203	Labor						
-204	M., S. & Misc.						
-205	Plant depreciation						
-206	General Expense						
	Sub-Total						
	Total						
	Total-Operation & Maintenance						

*Decrease

Miniature of a Form Printed on Letter-size Sheets for the Pumping Station Report

The figures given in the report do not include interest on the cost of construction. The cost of construction is given however so that the interest charges for any desired rate of interest can be computed to give a basis of comparison with private developments. All other costs including depreciation are included. The costs given in Table 1 are based on interest at 6 per cent. The interest cost per kilowatt hour of power used, per acre foot pumped and per foot acre foot are given. For plants operating with low load factors the interest cost may exceed the cost of the power. In the last column the proportion of the total cost represented by the interest charge is given. The 6 per cent rate of interest is lower than that paid on the actual cost by many pumping plants due to the discount at which securities have been sold.

The total costs, including interest, show that water is being lifted by plants pumping from large wells as on the Salt River project for from 3 to 7 cents per foot acre foot when the power can be cheaply secured. For large plants pumping from canals such as the Minidoka lifts the cost may be as low as 1c per foot acre foot. These costs can only be obtained however where the power is secured under unusually favorable conditions. Pumping at drops is also relatively low in cost, interest charges being much more important than operation expenses. With high load factors such plants give very low total costs. With temporary plants, for low lifts or for irregular operation, the costs per unit accomplished may be several times the general figures just mentioned.

Idaho, Utah, Wyoming and Montana possess vast deposits of high-grade phosphate rock. Although the phosphate areas are by no means completely surveyed, the amount of phosphate in the known deposits, as estimated by the United States Geological Survey, Department of the Interior, is nearly five and one-half billion tons. An idea of the immensity of this tonnage may be obtained by comparing it with last year's production in the United States of 1,980,000 tons. Thus it is seen that electro-chemical industries in the West have a brilliant future before them.

Table 1.—Operation Records of Irrigation Pumping Plants of the U. S. Reclamation Service for 1915-16

Plant	Type of Plant	Capacity of Prime Movers—H.P.	Number of Units	Head Pumped Against—feet	First Cost of Plant	Energy Used for Pumping, kw.-hr.	Acre Feet Pumped	Kilowatt Hours Used per Foot Acre Foot	Seasonal Plant Efficiency, per cent	Annual Load Factor, per cent	Cost of Plant: Per h.p. of Prime Mover	Cost of Plant: Per Second Foot of Capacity	Cost of Operation: Per Acre Foot Pumped	Cost of Operation: Acre Foot Per Foot	Interest on First Cost of Plant at 6%: Per Acre Foot Pumped	Interest on First Cost of Plant at 6%: Per kw-hr. Used	Interest on First Cost of Plant at 6%: Per Foot Acre Ft.	Total Cost per Foot Acre Foot	Interest Cost, Per cent of Total
Salt River Project.																			
Battery A	Vertical	75	1	49.0	$16,425	57,300	632	1.85	55.5	11.7	$219	$2050	$1.93	3.9c	$1.57	1.7c	3.2c	7.1c	45
B	Motor	75	1	46.2	20,604	139,128	1,775	1.70	60.2	28.3	275	2060	1.18	2.6c	.70	.9c	1.5c	4.1c	37
C	Driven	75	1	48.4	16,735	141,891	1,843	1.59	64.5	28.8	223	1670	1.00	2.1c	.54	.7c	1.1c	3.2c	35
D	Centrif-	75	1	46.5	19,358	158,220	2,262	1.50	68.3	32.2	258	1940	.99	2.1c	.51	.7c	1.1c	3.2c	34
E	ugal	75	1	44.5	21,848	146,453	1,978	1.65	62.1	29.8	290	2180	1.17	2.6c	.66	.9c	1.5c	4.1c	36
F	Pumps	75	1	32.0	16,808	108,060	1,489	2.28	45.0	22.0	225	1680	1.19	3.7c	.68	.9c	2.1c	5.8c	36
McQueen Well...		75	1	40.0	17,254	60,601	675	2.25	45.6	12.3	230	1730	.88	2.2c	1.54	1.7c	3.8c	6.0c	64
Clemons	Horiz. Motor	100	1	31.3	8,124	156,602	1,945	2.56	40.1	23.8	81	740	.97	3.1c	.25	3.1c	.8c	3.9c	20
San Francisco..	Driven Cent.	100	1	30.0	29,979	40,984	526	2.60	39.5	6.2	300	5000	3.54	11.8c	3.40	4.4c	11.3c	23.1c	49
High Line.....	Pumps	450	3	43.0	27,229	1,716,910	24,500	1.40	73.2	58.3	61	....	.55	1.3c	.07	.1c	.2c	1.5c	13
Minidoka Project.																			
First Lift...	Vert. Motor	2760	5	29.1	180,314	8,182,910	177,400	1.58	65.0	45.3	65	246	...	....	.06	.1c	.2c	1.0c	20
Second Lift..	Driven Cent.	2400	4	30.3	187,090	12,199,400	147,400	1.73	59.3	47.0	78	304	.24	.8c	.08	.2c	.2c	1.0c	20
															.07	1	...	....	..
Third Lift...	Pumps	1560	3	29.9	99,951		87,100				86	230	...	...	.07	..	.2c	1.0c	20
West End....	Horiz. Motor	150	2	20.8	18,372	342,076	6,820	2.42	42.4	34.8	122	920	.29	1.4c	.16	.3c	.8c	2.2c	36
1812 Station.	Driven Cent.	5	1	3.8	1,009	3,386	230	3.90	26.3	10.2	200	....	.41	11.0c	.26	1.8c	6.8c	17.8c	38
A 4 Station....	Scoop Wheel	25	1	2.9	3,202	19,726	1,997	3.39	30.3	12.0	128	....	.11	3.7c	.10	1.0c	3.4c	7.1c	48
Huntley Project.	Vert. Turb.																		
Balantine	Driven Cent.	596	2	46.3	71,522	.....	6,508	...	...	...	120	1275	.05	.1c	.66	....	1.4c	1.5c	92
Yakima Project.																			
Snipes Mount	Vert. Turb.	500	2	197.	.....	.....	2,005	...	...	...	...	....	1.15	.6c	1.26	....	.6c	1.2c	52
Hillcrest ...	Driv. Cent.	35	1	103.	5,660	.....	175	...	...	...	162	....	.35	.3c	1.94	....	1.9c	2.2c	85
Yuma. Reservation Drainage ...	Gas Engine	110	2	5 to 6	6,776	.....	2,800	...	....	...	62	....	.58	10.6c	.14	....	2.6c	13.2c	20
Yuma Valley..	Driv. Cent.	40	2	4	900	.....	758	...	...	...	22	....	.93	23.2c	.07	....	1.8c	25.0c	7

THE BONUS, WATER RIGHT VALUE, APPRECIATION

BY C. E. GRUNSKY

(The rate-base is dependent upon several variables that must be most carefully considered in any discussion of utility earnings. The bonus, the water right value, and appreciation are factors that need especial attention. These factors are dealt with in the following discussion and illustrations are drawn by the author who is a consulting engineer at San Francisco and a well-known writer and authority on the subject of rates.—The Editor.)

The question is sometimes asked, "How does a bonus affect the rate-base?" The answer to this question should be given with due regard to all circumstances. Thus for example, if the owner is given a bonus to build a steamboat equal to the entire cost of the steamboat and the earnings are such that within the life of the boat there will be a surplus, above operating cost plus compensation to the owner for management, such that this surplus will build a new steamboat, the owner will have at no time made any investment and it may be proper to use a rate-base without inclusion of the steamboat. If, however, the earnings have yielded only a moderate excess over operating expenses and no fund has been, nor could have been created out of surplus earnings from which to pay for the renewal of the steamboat, then the new steamboat will have to be constructed with funds borrowed or at any rate contributed by the owner. The original bonus will have disappeared as a business loss and the cost of the new steamer will be included in the rate-base. Or, as another illustration, in the interest of some local project as, for example, the development of a coal mine a line of railroad is built which is then turned over as a gift, subject to the condition that it be operated, to some larger railway system. The new owner of the railroad in this case has made no investment. The coal road may not pay. Perhaps its earnings will just offset operating expenses including a proper allowance for replacement (depreciation). The new owner has made no sacrifice to acquire the coal road. Its cost need not be included in the rate-base unless the addition of the road as a profit allowance is justified by circumstances. In most cases in practice the latter will be proper and ordinarily when long established systems and long past transactions are under review no other course would be followed. The situation is similar when a tract of land is laid out in town lots and the streets are improved and water and gas mains are laid and these mains are then donated to the established water and gas companies with no condition other than that water and gas be supplied to those who locate upon the tract. Here again the owners of the water and gas works enter into obligations to operate and maintain the additions to their systems; but they have made no sacrifice to secure these additions which in the end will be paid for by the purchasers of the lots in the subdivided area. Consequently these additions should not appear in the rate-base, at least not at full cost until the demand upon them is so large that their inclusion will not be a burden upon the rest of the system. Whenever included, unless they have been operated at a loss (receipts less than operating expenses), their inclusion will be enuivalent to a profit allowance to their owners. Good practice would be to give preference to the inclusion of such donation except when they are of recent date or when other circumstances warrant a special investigation to determine the course of action.

That a water-right has value is now a generally recognized fact. When water is used for irrigation it assists in producing a crop which can be put on the market at prices not subject to regulation. The water delivered at the irrigated farm has a value determinable from the profit which it enables the farmer to make by increasing the crop output of his soil. The water in the stream from which the canal system obtains its water for delivery to the farmer, has greater or less value according to many modifying factors such as the character and value of the crop irrigated; the amount of water required to produce the crop; the cost of the canal system in relation to the acreage served; the quality of the water; the availability of alternative sources of supply; the limit of the supply in the available sources in comparison with the area of irrigable lands; the cost of preparing the land for irrigation; and the prospective demand upon the source of supply for higher uses of the water. The riparian right, too, has value not alone because the water is in the stream at the border of the land but also because under the doctrine of riparian rights the land owner has a limited right to use the water. Consequently when there is any new development involving the utilization of water the adjustment with the owners of prior rights may involve an outlay. In any well settled region, the cases will be rare in which water can be had without cost. Any legitimate expenditure for water-rights by the owner of a public utility is to be made a part af the rate-base. Whenever, therefore, the time has come when the use of the water is a necessity and there is no cheaper alternative source of supply a strategic value may result as in the case of rates which were determined by the less favorable situation of some other concern operating in the same territory. On this subject the following is taken from "Valuation, Depreciation and the Rate-Base," page 216:

"As an illustration of special water-right value the case of a water supply for general and domestic use which affords water of prime quality in limited amount may be taken, but which, when compared with other sources in use in the same community, has the advantage of proximity, elevation and reliability of service.

"Let it be assumed, for example, that such a supply was the first to come into use, that its water was distributed as required throughout the built-up section of a growing town, but that at length a time came when additional water had to be brought in by a second system from some remote source, and that at the time of the valuation the distributing pipes of each of the two systems cover practically the entire built-up territory. The original water-works may now be supplying only a small fraction of the aggregate amount of water being used. Undoubtedly under such circumstances, the charge for water by the two concerns would be the same or very nearly the same. The water from the newer works could not be supplied at a low enough rate to drive the earlier concern out of business. Without any reduction of rates, this original utility should hold its customers. There need be no falling off in the amount of water which it sup-

plies, assumed to be the limit of its capacity. But, if, as assumed, the rates charged by the two concerns are the same, the relative amount of net earnings will be greater for the original than for the new water-works. If it costs the original concern 17.5 cents per thousand gallons to develop and market its water crop (interest on the investment included) and it is costing the new concern 20 cents to do the same, and if this larger cost has been taken into account in fixing the water rates, then the water-right and other intangible elements of value of the original concern may reasonably be valued at ($200-$175) $25, per day per million gallons of daily delivery more than the water-right and other intangible elements of value of the new concern. This is interest on about $150,000, if 6 per cent per annum be made the basis of the calculation.

"If, in other words, rates are allowed which in the case of the new or main water-works system will create a water-right value of $50,000 per million gallons of daily delivery for the new water-works, then the value of the water-rights controlled by the original system may be about $200,000 per million gallons per day."

How to determine the value of a water-right is a question which has not yet been satisfactorily answered. There is no general market for water-rights. Their beneficial use is restricted to limited areas and to certain purposes such as the generation of power, irrigation and domestic use. It is not possible to go into the market at any time and to secure a bid for a water-right. Nevertheless there are cases in which a determination, at least of an upper or lower limit of value, can be made. The city of Sacramento, for example, draws its water direct from Sacramento River. The low water flow of the river at Sacramento is about 5000 cubic feet per second. The demand of the city upon the river in comparison with this volume is so small as to be almost negligible. The abstraction of the city water is no damage to navigation interests nor to the rights of riparian owners. The state has not exacted any payment for the privilege of taking the water. The water-right has only nominal value although the water is applied to the highest possible type of use.

In contrast with such a situation, there is the water power right controlled by riparian ownership in a region where the demand for power is such that the desirability of utilizing the water-power is unquestioned. The value of the power right in such circumstances is determinable from the market value of power as established by the use of oil or coal, as the case may be, provided always that the water-power is not of such magnitude as to completely crowd coal and oil out of the field. In the event that this happens the steam plant can do no more than determine an upper limit of the value of the water-power.

Conditions may be such that at current prices of fuel the cost of developing power is less with steam than with water in which event the wisdom of the water-power development may be called in question. But in view of the advantage to society of bringing all water-powers into use so as to conserve the consumption of the oil and coal, whose supply is limited, it should be assumed that the cases will be rare indeed in which the owner of the water-power plant should be denied all reward for having gone into the power business as he might be in case that no profit is allowed, the absence of which would eliminate all intangible values, including the water-right. When such a case is presented liberal treatment may be expected and even demanded as a reward for the conservation of power tat otherwise would be lost. The owner, even in such cases, is entitled to share in the benefit which he confers upon society.

Shall appreciation be allowed to the public utility and if so, how? Yes, but within limits. If instead of owning the properties whose value increases with age, such as real estate, these properties were leased from outside owners, the demand by such outside owners would be for rentals increasing with the increasing value. The increasing value may, therefore, be allowed, but if allowed it is a part of the aggregate profit which should go to the owner as already explained, to permit him to participate in the general prosperity of the community, which is reflected in the appreciation, and to compensate him for management and business hazards. As the appreciation of real-estate is not regular and cannot be forecast with any great degree of precision, and as the appreciation in certain cases in the past has been beyond any equitable allowance of profit, it is more logical after regulation of rates has commenced and a proper rate-base has been once established, to treat appreciating property as having been dedicated to public use at its cost or, in some cases, at the estimated cost of reproduction when the initial valuation for rate regulation purposes is made, always conditioned upon the payment by the public of a reasonable amount for such use, and thereafter to let the general profit allowance include something for current appreciation, thus covering the owner's share in the general prosperity and protecting the rate-payer's participation in the utility's unearned increment. Under this system even the utility which does not own real-estate or other appreciating property would also get a fair share of the unearned increment It should be remembered, in this connection, that the value of money is constantly dropping. The rise in the value of real-estate is, therefore, not entirely due to the demand of society that it be used for higher purposes. This rise is in part due to the fact that as time goes on the same amount of money will purchase a smaller amount of service or of the necessities and conveniences that make life possible and worth while. It is the function of the profit allowance to meet this hazard among the others which would in part be covered by appreciation for the utility rich in real-estate, but to which other utilities which own no realty are also entitled. Herein will be seen good reason for adopting the writer's suggestion of bringing the profit allowance into a fair relation to the volume of business.

To illustrate some of the fundamental principles in their practical application, a railroad property may be brought under consideration which has been long in operation. By an examination of book records and a physical valuation it has been determined that the legitimate original cost of the railroad may be taken at $20,000,000 and that ordinary operating expenses are $2,000,000 and the average annual expenditures for replacements are $500,000 per year. In making an appraisal of value in conformity with the requirements of the Interstate Commerce Commission, it is found that the accrued depreciation of physical properties is $4,000,000. The appreciation in this case and the cost of developing the business are assumed to be in-

cluded, so far as allowable, in the $20,000,000. The bonds of the road are 6 per cent and a fair allowance for discounts and commissions shows that 7 per cent would be a fair net rate of interest on borrowed money free from any profit increment.

Under the proceedings as they are customary the further inquiry would relate to the "going value" and to the proper rate of return on the fair value of the property. Suppose the going value is allowed at $2,000,000 and that 8 per cent be agreed upon as a fair rate of return.

According to the usual custom the allowable earnings would be found as follows:

Cost new	$20,000,000	
Accrued depreciation	4,000,000	
Cost new less depreciation	$16,000,000	
Going value	2,000,000	
The present or fair value	$18,000,000	
Required Earnings—		
Operating expenses		$ 2,000,000
Replacement allowance (depreciation)		500,000
Return allowance 8 pe rcent on $18,000,000		1,440,000
Required earnings		$ 3,940,000

Besides this there will be some more or less definite amount of appreciation which does not lend itself to inclusion in such figures as these

According to the alternative plan under which accrued depreciation is ignored, as of no effect upon the rates:

Rate-base, original investment = $20,000,000.	
Required Earnings—	
Operating expenses	$2,000,000
Replacement allowance	500,000
Interest 7 per cent on $20,000,000	1,400,000
Profit allowance 10 per cent of the annual income about	400,000
	$4,300,000

Either there must be considerable property in the possession of and in use by the railroad company of the type, which is increasing in value; or, under the first procedure, the allowed rate of return, 8 per cent, is too small; or, the allowance for going value is too small. If the last suggestion were the correct one and not supplemented by other factors, then "going value" should be increased to about $7,000,000 instead of the $2,000,000 introduced into the calculation. If the correction is to be made in the rate of return this would have to be allowed at about 10 per cent instead of at 8 per cent.

The advantage of bringing the profit allowance into a fair relation to the volume of business is best apparent in the case of a utility which does a large amount of business on a small investment. Suppose that an express company has invested $1,000,000 and that its gross annual income for several years, has been about $4,000,000. If the accrued depreciation is $250,000 the ordinary procedure might be about as follows:

Present fair value of physical elements, etc.—		
Estimated cost new	$1,000,000	
Accrued depreciation	250,000	
Cost new less depreciation	$ 750,000	
Going value possibly	2,000,000	
Fair value	$2,750,000	
Required Earnings—		
Operating expenses		$3,400,000
Replacement allowance		100,000
Return allowance 17½ on $2,750,000		480,000
Total		$3,980,000

It will be noted that the return rate is introduced into the calculation fairly high, because the investment is small and the courage is lacking to make the intangibles appear in the rate-base at $5,000,000, or more, as they probably would be rated by a purchaser if the business is a monopoly.

Under the alternative plan the accrued depreciation would again be ignored and the profit allowance would, perhaps, be about 10 per cent on the volume of business:

Rate-base, the original investment = $1,000,000.	
Required Earnings—	
Operating expenses	$3,400,000
Replacement allowance	100,000
Interest 7 per cent on $1,000,000	70,000
Profit allowance 10 per cent on $4,000,000	400,000
Total	$3,970,000

When all the capital is invested in a single depreciating item, as in the case of a steamboat, as already described, the first step of the usual practice is to find the steamboat's remaining value, a value which changes from year to year. Suppose that the steamboat has cost $250,000; that it is found upon examination that it should serve about 5 years longer; that a steamboat of its type has a probable life when new of 20 years, and that the amount of business (gross income) has been about $500,000 per annum.

In this case the remaining value of the steamboat would be determined by the sinking fund method and for a remaining life of 5 years in a 20-year life table at 7 per cent would be found to be $97,000. Assuming the steamboat business to be a monopoly there would be something added for going value, perhaps as much as a new steamboat would cost or $250,000.

The required earnings would be—	
Operating expenses	$400,000
Replacement or depreciation allowance by the compound interest method; the amount which will retire the remaining value in 5 years, 7% interest	17,300
Return allowance 20% on ($97,000 + $250,000)	69,400
Total	$486,700

While the question whether or not the earnings in the past have actually been sufficient to yield interest on the investment from the beginning plus the increment supposed to have been applied from year to year to retire capital will be a proper one, the large allowance of intangible value covers any possible past deficiency. This large allowance results from the consideration, it is assumed, of all the circumstances such as hazard, fluctuation in the annual volume of business and the like.

Under the simpler alternative procedure the original investment, $250,000 would be the rate-base and the required earnings would be estimated as follows:

Required Earnings—	
Operating expenses	$400,000
Replacement allowance sinking fund method 20 year life 7 per cent	6,100
Interest 7 per cent on $250,000	17,500
Profit allowance about 12 per cent of $500,000	60,000
Total	$483,600

SOME OF THE PREVENTABLE WASTES IN AMERICA

According to S. W. Straus, in America we waste $40,000,000 a year in the careless handling of eggs; we waste $5,000,000,000 in soil erosion; $238,000,000 in losses through floods and freshets. We are letting $600,000,000 worth of energy go to waste; $659,000,000 a year through losses in crops by insects which could be largely prevented by more careful methods of agriculture.

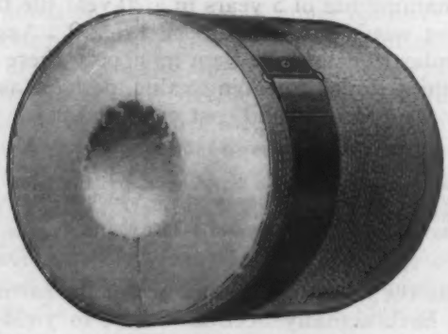
TYPES OF PRACTICAL HEAT INSULATION

BY JOHN CRAWFORD, JR.

(Practical heat insulation is a question of vital importance throughout the West, where electric heating is daily growing in importance as a profitable central station load. The mathematical analysis of heat flow in relation to costs involved in different types of heat insulating materials is of timely interest. Here is a paper by the manager of the asbestos and magnesia department of the H. W. Johns-Manville Company at San Francisco that should prove of great practical value in that these economic features are treated in a concise manner so that many points hitherto misunderstood are made clear.—The Editor.)

In designing heat insulation, man has done well to pattern his products after nature, for nature has provided her members of the animal and vegetable kingdom, where necessary, with most efficient forms of heat insulation known.

For example: The Eider duck, with not over an inch of feathers to insulate its body temperature of 98° F., can remain motionless in a temperature of 90° below zero for eight or nine hours at a stretch without freezing. But, see how nature has taken advantage of the laws of heat flow, in protecting it. The quill of each feather and each branching little barb is made of a material which is itself a very slow conductor of heat, and as each little feather is hollow, it encloses dead air, which is the slowest conductor of



Magnesia Pipe Covering

heat. The feathers lie one on top of the other so that between each two feathers there is an additional film of dead air. Thus, nature has provided against the loss of heat by conduction and convection and to reduce the loss by radiation, she has made the feathers white, smooth, and glossy on the surface.

The feathers of a bird find an analogy in the felted types of man-made heat insulation, such as asbesto-sponge felt and wool felt.

Next to the feathers of a bird, nature's best heat insulation is the fur of animals, especially the reindeer. Patterned after this is man-made hair felt. Next comes the bark of trees, which may be compared in design and insulating value to the well-known 85 per cent magnesia, diatomaceous earth and asbestos, and similar types of molded insulations.

Nature offers us no examples of the more inefficient forms of man-made insulation, such as "Air-Cell." Even the hollow bamboo stem is sealed off at intervals to reduce convection currents, and has an outer shell containing a large amount of dead air to retard conduction and a smooth, glistening surface to check radiation.

Commercial heat insulating materials may, for convenience, be divided into three groups, viz:

1. Those designed to insulate pipes.

2. Those designed to insulate large flat surfaces or large surfaces of little curvature.

3. Those designed to fill in the space between walls.

In the first group, we have pipe insulation which is furnished usually in sections three feet long to fit snugly the outer surface of standard pipes. *In the order of their efficiency in retarding the flow of heat, the best known of these are asbesto-sponge felt, hair felt, cork, 85 per cent magnesia, diatomaceous earth and asbestos, wool felt, plastic magnesia, cement, carocel and asbestocel, plastic asbestos cement, and air-cell.

In the second group, we have the same materials but furnished in blocks, 6 in. by 36 in., or in sheets, 24 in. by 36 in., or larger where the nature of the material permits.

In the third group, we have such substances as diatomaceous earth, granulated cork, dry magnesia and asbestos cements, mineral wool and loose asbestos.

Such of these materials as are of organic origin are not ordinarily used where temperatures much exceed 212° F. The temperature at which the other forms can be satisfactorily used is limited only by how greatly their retardance of heat flow diminishes as the temperature increases.

Mathematics of Heat Flow

(1) The rate of speed with which heat will flow from a warmer surface to a cooler one depends on the difference in temperature between these surfaces and on the nature of the medium through which the heat is traveling—i.e. its thermal conductivity.

(2) The total amount of heat which flows from a warmer surface to a cooler one in a given length of time depends—

(a) On the difference in temperature between the two surfaces.

(b) On the thermal conductivity of the medium through which the heat is traveling.

(c) On the thickness of the medium through which the heat is traveling.

(d) On the ratio of the area of the cool surface to the area of the warm one.

In the practical application of heat insulating materials, it is the maximum economical reduction of actual heat losses in which we are interested, not simply the rate of heat flow. Yet, in specifying the thickness of non-conducting materials to be used, this fact is frequently lost sight of.

Heat traveling from the warmer side to the cooler side of a flat plane, will flow in approximately parallel lines, but heat traveling into or out from a cylinder, a sphere, or a cube, travels in radiating lines to or from a theoretical central point.

*L. B. McMillan, Trans. A. S. M. E. No. 1514, Dec., 1915. C. P. Randolph, Gen. Elec. Review, Feb., 1913.

Thus, in insulating pipes, tanks, boilers, retorts, furnaces, etc., against heat loss, it should be borne in mind that the most economical thickness of insulation to use, will vary with the relation of the area it is to proportion the thickness of insulation to the area of the inner surface which is the source of the heat flow.

Chart No. 1 shows graphically how very important it is to proportion the thickness of insulation to the internal volume of the source of heat flow. The limiting factor which determines the most economically efficient thickness of insulation is only reached when the value of the additional heat saved by increasing the thickness of the insulation does not show a yearly return commensurate with the additional investment.

This chart also illustrates that the loss of heat per unit of interior volume can be reduced more economically where the volumes are large then where they are small. This is because the amount of heat flow depends on the ratio of the inner surface which is the source of heat to the outer surface which is radiating the heat.

This ratio increases directly with the diameters of the inner and outer surfaces, but the interior volume increases very rapidly as the diameters increase. In the case of cubes and spheres, the interior volume increases as the cube of the diameter and in the case of cylinders, the interior volume increases as the square of the diameter.

It may be well to illustrate by a typical problem the economy of proportioning the thickness of insulation used, (all other things being equal) to the volume of the source of heat—

Mathematical Analysis

The amount of heat flow is usually expressed by the formula—

$$H = K\,(T' - T)\,\frac{A}{L} \qquad \text{Where}$$

H = Amount of heat transferred per unit of time.
K = is a constant determined empirically, which indicates the rate of heat flow per unit of time for any particular material.
T' = Temperature of hotter surface.
T = Temperature of cooler surface.
A = Mean area of an outer surface S' and an inner surface S.
L = The distance between the surfaces S and S'

Now if the heat is traveling through the walls of a long cylinder, such as pipe insulation, the mathematically correct formula becomes:

$$(5)\quad H = K\,(T' - T) \times \frac{S' - S}{*2.303\,(\text{Log } S' - \text{Log } S) - L}$$

*Conversion factor Nap. to Com. logs.

If the heat is traveling through the walls of a sphere or a cube, the mathematically correct formula is:

$$(6)\quad H = K\,(T' - T) \times \frac{\sqrt{S'} - S}{L}$$

However, for the most practical problems, a formula which uses the arithmetical mean of S' and S is sufficiently accurate, viz:

$$(7)\quad H = \frac{K\,(T' - T)}{L} \times \frac{S' + S}{2}$$

It will be apparent that the factor K which denotes the rate of heat flow is the reciprocal of a factor which denotes the ability of any particular material to resist this heat flow.

Hence, $K = \frac{1}{R}$

It is often more convenient to use the reciprocal, especially when we have a series of materials of different conductivities and different thicknesses. Thus if r, r', r'', represent the respective thermal resistances and L, L', L'', the respective thicknesses of a series of heat insulating materials in contact, we may use the simple formula:

$$(8)\quad H = \frac{T' - T}{rL + r'L' + r''L''} \times \frac{S' + S}{2}$$

Now let us compare the total amount of heat flow through one foot of one inch of asbesto-sponge felt insulation on a 1-inch pipe and on a 12-inch pipe, respectively—the pipes to contain steam at 150 lb. pressure and the temperature of the surrounding air to be 75° F.

T' = 366° F. (the temp. corresponding to 150 lb. steam pressure).
T = 75° F.
K = for steel pipe 417 B.t.u. per sq. ft. per hour, per inch thickness, for each degree F. temperature difference between hotter and cooler surfaces. Hence its thermal resistance is only 0.0024 resistance units, which is so slight that the difference in temperature between the inside and outside of the pipe may be omitted.

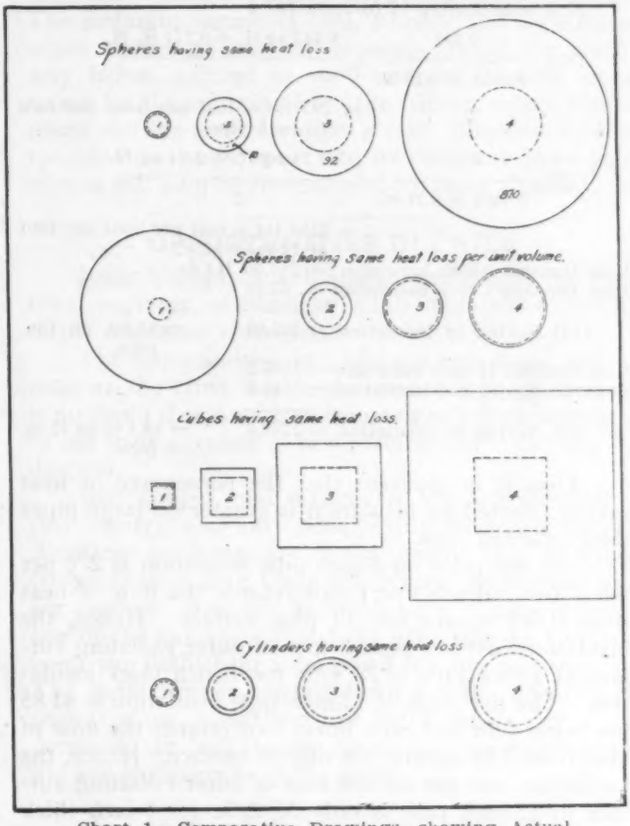

Spheres having same heat loss
92
870
Spheres having same heat loss per unit volume.
Cubes having same heat loss.
Cylinders having same heat loss

Chart 1. Comparative Drawings, showing Actual Loss and Same Relative Loss

K = for asbesto-sponge felt at approximately 300° F. temperature difference (C. P. Randolph, Gen. Elec. Review, Feb. 1913), is 0.33 B.t.u. per sq. ft. per hour, per inch thickness for each degree F. difference in temperature between the hot surface and surrounding air.

$R = \frac{1}{0.33} = 3.03$ resistance units.

L = for asbesto-sponge felt is 1-inch.
S' = 0.343 sq. ft. for 1-inch pipe covering = 3.34 sq. ft. for 12-inch pipe covering.
S = 0.866 sq. ft. for 1-inch pipe covering = 3.86 sq. ft.
Substituting in formula (8) for 1-inch pipe, we have:

$$(9)\quad \frac{366° - 75°}{3.03 \times 1\text{-inch}} \times \frac{0.343 + 0.866}{2} = 57.98 \text{ B.t.u. loss per hour from 1 ft. of 1-inch pipe insulated with 1-inch asbesto-sponge felt.}$$

For 12-inch pipe:

$$(10)\ \frac{366^\circ - 75^\circ}{3.03 \times 1\text{-inch}} \times \frac{3.34 + 3.86}{2} = 345.6 \text{ B.t.u. loss per hour from 1 ft. of 12-inch pipe insulated with 1-inch asbesto-sponge felt.}$$

It has been found empirically (L. B. McMillan Trans. A. S. M. E. Dec., 1915) that at 300° temperature difference between steam and air, steel pipe shows a drop of 2.3° F. for 1-inch thick, from inside surface of pipe to outside surface. As 1-inch pipe is only 0.13-inch thick, the temperature drop would be: 2.3° × 0.13 inch = 0.299° F., beween the inside and outside of pipe.

For 12-inch pipe the temperature drop would be:

2.3° × 0.37-inch = 0.851° F. Hence,

T′ — T for 1-inch pipe = 0.299°,

and T′ — T for 12-inch pipe = 0.851°.

S′ for 1-inch pipe = 0.274 sq. ft.; for 12-inch pipe 3.14 sq. ft.

S for 1-inch pipe = 0.343 sq. ft.; for 12-inch pipe 3.34 sq. ft.

L for 1-inch pipe = 0.13 inch for 12-inch pipe 0.37 inch.

$$R = \frac{1}{417} = 0.0024 \text{ resistance units.}$$

Now substituting in formula (8):

$$(11)\ \frac{0.299^\circ}{0.0024 \times 0.13 \text{ in.}} \times \frac{0.343 \text{ sq.ft.} + 0.274 \text{ sq. ft.}}{2}$$

= 295 B.t.u. lost per hour per foot of 1-inch pipe.

$$(12)\ \frac{0.851^\circ}{0.0024 \times 0.37 \text{ in.}} \times \frac{3.14 \text{ sq. ft.} + 3.34 \text{ sq. ft.}}{2}$$

= 3105 B.t.u. lost per hour per foot of 12-inch pipe.

Loss through 1-inch bare pipe = 295.00 B.t.u.
Loss through 1-inch insulation = 57.98 "

(13) Saving by insulation = 237.02 " = 81.0% on 1 in. pipe.

Loss through 12-inch bare pipe = 3105.2 "
Loss through 12-inch insulation = 345.6 "

(14) Saving by insulation = 2759.6 " = 88.8 % on 12 in. pipe.

Thus it is apparent that the percentage of heat saving effected by insulation is greater on large pipes than on small ones.

The list price on 1-inch pipe insulation is 27c per lineal foot. Each lineal foot retards the flow of heat from 0.343 square feet of pipe surface. Hence, the insulation cost per square foot of outer radiating surface of 1-inch pipe is 78 4/5c for 1-inch thick insulation. The list price of 12-inch pipe insulation is $1.85 per lineal foot and each lineal foot retards the flow of heat from 3.34 square feet of pipe surface. Hence, the insulation cost per square foot of outer radiating surface of 12-inch pipe is only 55 2/5c for 1-inch thick insulation.

The list price for 2-inch thick insulation, 12-inch pipe, is $2.70 per lineal foot. Hence, the insulation cost per square foot of outer radiating surface for 2-inch thick insulation on 12-inch pipe is 80c per square foot or only 1½c per square foot more that 1-inch thick insulation on 1-inch pipe.

For insulating surfaces 12 inches in diameter and larger where insulating blocks, (3 in. by 36 in. or 6 in. by 36 in.) can be used, this cost per square foot decreases still more—i.e. the price of 2-inch thick blocks is 60c per square foot and of 2½-inch blocks 75c per square foot. Allowing 3½c per square foot for the finishing cement and canvas, the cost per square foot of radiating surface for 2½-inch thick insulation on 12-inch surfaces and larger is the same as the cost of 1-inch thick insulation on 1-inch pipe.

The actual heat loss in terms of fuel and lessened operating efficiency increases with the size of the radiating surfaces. The heat saving efficiency per square foot increases and the cost of insulation per square foot decreases with the circumference of the radiating surface. Hence, it does not seem to be a question of whether one can afford to use thicker insulation on large surfaces but whether one, in the interests of economical operation, can afford not to.

From statement (14) we note that the saving effected by insulating 1 lineal foot of 12-inch pipe with one inch of asbesto-sponge felt is 2759.6 B.t.u. per hour.

Taking fuel oil (which is the cheapest fuel we have) at 18,500 B.t.u. to the pound, this saving is equivalent to a saving of 0.149 lb. of oil.

It has been determined empirically (L. B. McMillan) that at 300° temperature difference 2-inch thick asbesto-sponge felt insulation will show an increase in heat saving of a little more than 40 per cent over 1-inch thick. Hence, if 2-inch thick insulation had been used the heat saving would be equivalent to 0.248 lb. of oil per lineal foot per hour.

The list price of 2-inch thick asbesto-sponge felt sectional insulation for 12-inch pipe is $2.70 per lineal foot and for 1-inch thick, $1.85. The increased cost of using 2-inch thick insulation over 1-inch thick is therefore 85c per lineal foot. The increased fuel saving is 0.099 lb. of oil per foot per hour.

Assuming oil to be worth $1.25 per bbl. of 336 lb., or $0.0038 per lb., the increased fuel saving per hour is $0.000376 per lineal foot. Hence, to pay for the difference in cost between 2-inch thick and 1-inch thick insulation, it will take

$$\frac{\$0.85}{\$0.000376} = 2261 \text{ hours} = 3.1 \text{ months.}$$

Since the additional investment is amortized in three months by the increased saving, the economy of using the thicker insulation is self-evident.

NEW LAW FOR ELEVATOR INSPECTION

The bill which passed the last legislature, providing for inspection of Elevators, became effective July 27, 1917. It is known as Chapter 74, Laws of 1917, and stipulates that no power elevator or hand-power elevator shall be operated unless a permit to operate shall have been isued by the Industrial Accident Commission of the State of California, following an inspection either by a state inspector or an inspector holding a certificate of competency from the commission

It is made a misdemeanor to operate elevators without the permit, and each day of operation without such permit will constitute a separate offense.

The Industrial Accident Commission has sent out return post cards to all owners or operators of elevators, asking that request be made on the post cards for an inspection of the elevator or elevators concerned.

Provision is made in the law that no penalty shall be attached where an elevator is operating without a permit if application for an inspection shall have been made, but remains unacted upon. This means has been adopted by the Industrial Accident Commission in order that owners of elevators will not be liable pending the required inspection.

SHORT JOURNEYS IN PACIFIC LANDS

(The water spout is a phenomenon unknown to the American citizen, who has not traveled in the tropics. Here is a description of an experience of an American engineer off the Island of Formosa near the coast of China, which will be interesting to any engineer contemplating a visit to the tropics. Other short notations from Japan and Chile will be found which will also prove helpful in forwarding educative knowledge concerning our Pacific neighbors.—The Editor.)

A WATER SPOUT

The Swimming Tank Proved Popular Aboard Ship

ANOTHER phenomenon of the tropics which is interesting and at times a knowledge of which is of much importance to the engineer is the water spout.

Many of us have read of the wonders of a water spout; few, however, have beheld the actual beauty and grandeur of a perfectly formed phenomenon of this nature. When steaming between the domain of the Japanese Empire and the Philippine Islands, the morning of the second day found us some fifteen to twenty miles to the east of the great island of Formosa, formerly a Chinese possession, but since the Chinese-Japanese war a possession of the latter power.

The day opened up in gorgeous magnificence. The rugged mountainous contour of the island which is some three hundred miles in length was studded with white clouds and led one to imagine many a chilling tragedy as being enacted in the wild canyon chasms of these mountains to our starboard side, where wild men, still unsubdued, roam at large. Towards noon, the atmosphere became quite sultry and thunder clouds resting at a height of some 1500 to 2000 feet entirely obscured the former silhouetted outline of the island. Suddenly a cry from one of the passengers called the attention of all on board to a long, narrow, vertical, cylindrical shaped spray of cloud which opened out in funnel shape at the top and bottom some six miles to the starboard side. The captain quickly identified this phenomenon as one of the clearest drawn water spouts he had seen in ten years. The water spout continued in unbroken alignment for over an hour when it gradually seemed to fade away in mist.

The water spout is said to be formed in a manner similar to the whirlwind on land. Two rapidly but oppositely moving bodies of air coming into direct contact causes an intense rotary motion to take place which, due to centrifugal action of the moving air, creates a vacuum in its center. The pressure of the air upon the water surface being thus reduced causes the evaporation of huge quantities of water. This water vapor immediately surges upwards and deposits itself as fine spray in the clouds above.

It is said that the water spout is usually followed by rain. Whether this be true or not, in our case a hot sultry, humid afternoon prevailed to such an extent that life seemed unbearable in the cabins below; hence, practically all the cabin passengers decided to sleep on deck. The swimming tank was in constant service until about ten-thirty in the evening. About midnight a terrific gale began to blow. The captain immediately came down from the bridge and announced rain ahead. The midnight parade of cots, pillows, and nightshirts which ensued at once, all heading toward the hatchway below, offered in its humorous aspects much solace for the suffering from the stifling, sultry atmosphere and the loss of a night's rest. Needless to say, too, that the water spout and its resultant down-pour of rain will long be remembered by those aboard.

OPPORTUNITIES IN CHILE

Jorge Villegas, a well-known mechanical and electrical engineer, of Santiago, Chile, thus writes to one of his American correspondents:

The opportunities in Chile are enormous, and as soon as the crisis due to the war will be over, there is no doubt that American concerns will flock over here to get their supplies of raw material for American industries.

Iron, copper, coal, manganese, etc., are plentiful in this country, and have been hardly scratched. Many American engineers are of the opinion that, in about ten years from date, Chile will control the world's copper market. And this is the opinion of almost every one of the engineers that have been sent by Guggenheim, the Bethlehem Steel, and a few like corporations. The Bethlehem is tearing down a solid mountain of pure iron ore, something like 50,000 tons a day, I understand. In fact, the country is only waiting for capital and engineers to do the work.

ELECTRICAL ACTIVITY IN JAPAN

According to the latest investigations made by the authorities (December, 1916), the number of electrical enterprises in Japan, is estimated at about 642, having a total capital of 660,000,000 yen (a yen is about 50 cents in United States gold), and utilizing about 900,000 kilowatts per annum. Add to this the electricity generated in private plants, and the total figure amounts to about 1,150,000 kilowatts per annum. Compared with the figures of ten years ago, this shows an increase of about 260 per cent in number of enterprises; 400 per cent in amount of capital, and 380 per cent in kilowatts consumed. This rapid progress is due chiefly to the increased use of waterpower, which now supplies about 80 per cent of the electricity used.

ENGINEERING COMMERCIAL

PROBLEMS AND SOLUTIONS

PUBLIC POLICY ACCOUNTING

(Herein will be regularly found the questions that have been asked and the answers which have been given by members of the Pacific Coast Section of the National Electric Light Association. The purpose is to give terse replies to queries concerning electrical conditions peculiar to the Pacific Coast. All readers are invited to avail themselves of this new feature of Journal service by submitting questions or answers. Its value depends solely upon the use of it. Additional problems are solicited. All communication should be addressed to A. H. Halloran, Secretary Pacific Coast Section National Electric Light Association, 618 Mission Street, San Francisco.)

Public Policy

P. I. What are the purposes and provisions of the Walsh hydroelectric bill recently introduced in Congress?

John A. Britton, vice-president and general manager Pacific Gas & Electric Co., San Francisco: The recent introduction by Senator Thomas J. Walsh of Montana of a bill in Congress amending present acts relating to occupancy of government lands for hydroelectric development and prescribing methods by which present and past occupancy may be regulated achieves a new and very promising era in the much contended differences heretofore existing between hydroelectric companies and the government of the United States.

Under existing laws and the rules and regulations promulgated by the Departments of the Interior and Agriculture, there has been no disposition on the part of capital to embark on the rather uncertain proposition of developments hydroelectrically. The tendency of the rules and regulations heretofore promulgated and enforced has been to deter development and for the principal reason that the tenure of occupancy on government lands was uncertain.

Another vital objection to the regulations at present enforced is that an occupancy of government land, even though a minimum amount as compared with total development, places the entire development and everything connected therewith under governmental regulation. Also the tax imposed by the government, both in the construction period and the operating period, has been burdensome, considering the amount and value of land occupied.

The question of tenure is a most important one and the indefinite conditions of occupancy, subject to the will of the government, presented the greatest difficulty.

The Walsh bill, as framed, does away with the objections as to present conditions and, while not as liberal as it should be, taking into consideration the great benefits which will be derived by the utilization of the waters of any state for power purposes, yet is a big step in advance.

Briefly, the conditions are:

1st. Permissive occupancy of government lands for a fixed term of fifty years, and thereafter until government elects to take it over, or to lease it to another permittee, the original permittee having right of leasing as against any other person, if government decides to lease.

2d. Permitting all existing permits to be cancelled and new ones taken out under provisions of new law.

3d. That the United States will pay for the property if it takes it over. "Just compensation therefor in the amount which, were proceedings instituted for the purpose of fixing rates, should be found therein to be the investment of the permittee upon which he is entitled to a fair return."

4th. The bill also protects contracts made in good faith and approved by the public service commissions in each state.

5th. The charges according to the provisions of the Act are proportioned in relation to the amount of land occupied by water conduits, flooded areas, and structures to the entire land occupied by the development.

6th. The bill provides that where only 10 per cent or less of the lands is actually necessary and required for the development and "such government lands are to be used only for overflowage, reservoir, transmission, or conduit purposes and not in whole or in part as a dam site or the site of a power house nor for the erection of buildings or operation of machinery, the Secretary of the Interior may, in his discretion, upon application by the applicant waive such conditions, provisions and requirements of this Act as he may deem just."

The bill further provides that in case not more than 5 per cent of such lands are government lands, the Secretary of the Interior shall waive all of the conditions, etc., of the Act, excepting the permittee shall be required to pay the fair value of the use of such lands, and if the permittee and Secretary of the Interior cannot agree, then a value shall be determined by proceedings in the United States District Court.

Under such liberal provisions as the above there is no question but what rapid development of latent power possibilities will ensue.

In California, particularly, the ascending price of oil necessitates immediate development of hydroelectric properties and conservation could not be practiced in any more practical and energetic way than by such development, as for example—if approximately 200,000 h.p. of hydroelectric power could be further developed to displace oil there would be saved annually in the State of California approximately 6,000,000 barrels of oil, and I am assuming that 200,000 h.p. would reasonably represent the amount that could at present be saved were more hydroelectric power available.

It is to be sincerely hoped that congress at the present time will view the situation in California as in need of special legislation, as no other state is in the peculiar position of this state in its requirement of either oil or hydroelectric power for its farming, industrial and domestic purposes, and California has

no substitute for either oil or hydroelectric power as other states have in the possession of their coal fields, and to conserve the oil for purposes for which hydroelectric power cannot be used there can be no better argument than such liberal conditions and privileges of occupancy of government lands to develop water power as will make the conservation so devoutly wished.

Engineering

E. 1. Can fuses of 5 ampere capacity or less, be depended upon to blow within fifty per cent of their rated load on 2300 volt circuits? Are they mechanically satisfactory? If so, what make of fuse is employed?

D. J. Butts, Western Electric Company, Los Angeles.—Fuses afford a satisfactory means for protecting 2000 to 15,000 volt distribution secondaries. The Western Electric Company markets a fuse operating in oil, the fuse link being a 1 in. aluminum strip supported by spring fingers. When the fuse blows the fingers open out so that there is a 4 in. space between points. These fuses operate within 12 per cent of their rating and open rapidly under short circuit conditions wnthout injury to the renewable link. The renewal cost is about 12c.

C. 1. What are the electrical load characteristics of a wood pulp paper mill operating on the Pacific Coast?

J. W. Hungate, Spokane & Inland Empire Railroad, Spokane, Wash.—We furnish power to the Inland Empire Paper Company at Millwood, Wash., under a contract calling for the delivery of 2500 h.p. of primary power throughout the year and of 3500 h.p. of secondary power at such times as ample water is available. The primary power is used in the regular operation of the plant and the secondary power for cutting the logs into chips, which are stored for use throughout the year. The following gives requisite information:

The plant has an installed capacity of 5780 h.p. and has a monthly measured maximum demand and kilowatt hour consumption during the first 12 months as follows:

1916	Max. Demand	kw.-hr. Consumed
June	3980 kw.	2,229,600 kw.-hrs.
July	4160 "	2,465,400 " "
August	2670 "	1,472,600 " "
September	2430 "	1,451,600 " "
October	2210 "	1,316,600 " "
November	2520 "	1,455,200 " "
December	2720 "	1,580,200 " "
1917		
January	3300 "	1,978,400 " "
February	3460 "	1,973,200 " "
March	3720 "	2,152,000 " "
April	3910 "	2,260,800 " "
May	3600 "	2,069,000 " "

The monthly measured maximum demand is taken during a five minute period. Service is delivered at 60,000 volts and measured at 440 volts. The rate is $20 per h.p. per year for primary power and $10 per h.p. per year for secondary, with no discounts and no variation depending upon monthly or yearly output on sales.

E. 2. What are the advantages of grounding the secondaries of small transformers on a residence distribution system?

C. E. Young, Pacific Gas & Electric Co., San Francisco: (1) The company or customer will be able to detect accidental grounds on the service.

(2) The service is better protected from lightning, particularly when the transformers are affected.

(3) The service is protected should there be a break down between the primary and secondary of the transformer.

Awaiting Solution

A. 1. What methods have been employed with success in collecting over-due accounts?

E. 3. What is the impedance, reactance ohmic resistance and effective resistance of iron wire used to replace copper circuits for 2200 volt distribution work?

P. 2. In what spirit should public utilities meet municipal overtures to take over local distribution lines?

C. 2. Should a central station operating in towns of 5000 population or less encourage the entrance of independent electrical dealers? What assistance might be extended them?

E. 4. What pole height and spacing is advisable in building iron wire distribution lines?

C. 3. What effect is anticipated on current consumption for electric cooking and water heating if the high prices and security of oil and coal continue?

P. 3. Do the high costs of electrical equipment and increase in wages justify public service commission's raising rates for electric service? Would not such rate advances decrease current consumption to such a point as to make further raises necessary?

BRITISH COMMITTEE REPORT ON FATIGUE

As regards men engaged in heavy labor, data are not very complete, but as regards boys of 14 to 17, a reduction in the hours of labor from 73.3 to 57 produced an increase of output to the astonishing extent of one-third to one-half which indicates that the boys must have been overworked by long hours and that a reduction of 8 to 12 hours materially accelerated their rate of production.

On the whole, the committee comes to the conclusion that the hours of labor should be varied between wide limits according to the character of the work performed, and not maintained uniform for all types of labor and for workers of both sexes; and that where long hours of labor on the part of munition workers are necessary, an effort should be made to have them shut up in the factories for as short a time as possible.

In this connection attention is called to the importance of greater promptness in starting work. There can be no necessity for the waste of 25 min. in starting and stopping work, as was the case in a shop under investigation.

The custom in many munitions works is to work for a spell of 5 hours and then after an hour's interval for another spell of 4½ to 5 hours, which leads to spells which are undoubtedly too long in many types of munition work. A better plan would be to arrange for regular rest pauses in between. For instance, a 10 min. break in the middle of the morning and afternoon spells during which the operatives remain at their machines to take tea or other nutriment.

RECENT ADVANCES IN WESTERN WATER LAW

BY A. E. CHANDLER

(The proper procedure in the appropriating of water is a matter of great importance throughout the West, where the validity of a power development may at times be brought into question, due to the fact that the original filing was made in an improper manner. In this article the author, who is a well-known authority on water right law and a member of the California Water Commission, sets forth recent cases that relate to the appropriation of water and steps down their meaning in clear concise words for the information of the engineer.—The Editor.)

RECENT CASES RELATING TO THE APPROPRIATION OF WATER

Grant Realty Co. v. Ham, Yearsley & Ryrie, Wash., 165 Pac. 495

Diligence in Construction Work.—The statutory method for the appropriation of water in Washington (prior to the adoption of the water code by the 1917 legislature) was similar to the method provided in California and other western states requiring posting and recording notice and prosecution of construction work with reasonable diligence to completion and diversion of water. In the Grant Realty Company case it was contended by the company that Ham and his associates had not prosecuted construction work with reasonable diligence after the posting of notice of water appropriation. The point in issue was the delay necessitated by condemnation of the lands necessary for construction purposes at Moses Lake, the waters of which had been appropriated. The company contended that the delay caused by litigation offered no excuse for failure to prosecute work diligently. The supreme court held, however, that "condemnation for a site for an impounding dam or intake by an appropriator who does not own such a site is just as much matter incident to the enterprise to which the dam or intake is an essential as is the actual construction of the dam or intake. It would be simply idle to confer, as our statute does confer, upon the owner of non-riparian lands the right to condemn for such purpose if the time necessarily consumed in the condemnation must be entered in red on the ledger of diligence, and thus defeat his right of priority by relation, which the statute as a whole was intended to give. If time necessarily consumed in condemnation must be charged as time lost through lack of diligence under the statute, then every enterprise in which the condemnation of a site for diversion works is necessary is a defeated enterprise at its inception and the statutory right to condemn is not a right but a snare. * *" The condemnation suit itself must be prosecuted with reasonable diligence and the court held in the present case that the suit had been so prosecuted.

SYNOPSIS

Recent cases emphasize necessity for securing right of access to stream in appropriating water and also that courts use standards which are reasonable in passing upon "due diligence" in construction work under water appropriations.

The exact quantity of water which a riparian proprietor is entitled to use for irrigation, cannot ordinarily be ascertained in advance, for the reason that the right of each must be exercised in subordination to that of all the others.

It is also claimed that Ham had failed to exercise reasonable diligence because no work had been prosecuted on that part of the project not including the dam site which was being condemned. In dismissing this contention the court said "The dam and outlet works will cost about $65,000; the ditches, flumes, and pipe lines about $595,000. The interest on that sum since the commencement of the condemnation suit, October 7, 1910, at 4 per cent to this time, would amount to nearly $150,000. This all to no purpose, since the line must have lain idle till the dam site could be secured, and the ditches, flumes, and wooden pipes without water would have probably so deteriorated as to require a practical reconstruction when the dam site shall be secured. The law of diligence is not a rule of unreason and waste."

Alaska Juneau Gold Mining Co. v. Ebner Gold Mining Co., 239 Federal 638

Necessity of Access to Stream in Appropriating Water—Measure of a Right by Appropriation.—Alaska has no statutes governing the appropriation of water. The right to appropriate is governed by the rules of the local mining districts. As elsewhere in the west, the practice has been followed by posting and recording notices of water appropriation. In the Alaska-Juneau case the Alaska Company attempted to show rights by appropriation superior to those of the Ebner Mining Company. The Alaska Company posted its notice of appropriation upon a mining claim which later became the property of the Ebner Company. The Federal Circuit Court of Appeals held that as the act was without the consent of the owner of the property it was an act of trespass and could not become the basis of a right to appropriate. The court quoted in full the following from the Cyclopedia of Law and Procedure. "The right of appropriation extends only to waters upon the public domain of the United States, or upon the public lands of a state, for one cannot acquire a water right on land held in private ownership by another without acquiring an easement in such land." 40 Cyc. 704.

The above quotation does not mean that an appropriation cannot be made upon private lands, but

simply means that the right of access to the stream must be obtained from the lawful owner before the appropriation can be considered valid. In this connection it is well to refer to the very definite statement in Duckworth v. Watsonville, etc., Co., 150 Cal. 520, in which it is said: "The right to appropriate water under the provisions of the Civil Code is not confined to streams running over public lands of the United States. It exists wherever the appropriator can find water of a stream which has not been appropriated and in which no other person has or claims superior rights and interests."

It was claimed by the Alaska Company that the Ebner Company had not prosecuted its work with reasonable diligence, but the court held that although there was evidence of a temporary suspension of activity such activity was due to a "series of hostile acts" on the part of the Alaska Company and therefore excusable.

In its findings of fact the lower court had fixed the capacity of the diversion flume of the Ebner Mining Company at 3200 inches, but in its decree it awarded said company 10,000 inches—the amount stated in the notice of water appropriation posted in behalf of said company. In remanding the cause to the court below the Circuit Court of Appeals ordered that the decree should be changed to conform to the capacity of the flume. This order is in accordance with the well accepted principle that the first measure of an appropriator's right is the amount stated in his notice, but that his right upon the completion of his diversion works is limited to the capacity of such works.

Basinger v. Taylor, Idaho, 164 Pac. 522

Preference Water Rights—Water Right Permits.—Section 3 of article 15 of the constitution of Idaho provides that those using water for domestic purposes shall have the preference over those claiming for any other purpose in times of insufficiency of water supply. In the Basinger case the trial court, relying upon the above provision, decreed that a prior right for irrigation purposes should be subject to diversion "for domestic uses and culinary purposes" on the part of a subsequent appropriator. The supreme court, however, held that the usage for such superior purposes is subject to the provision of section 14 of article 1 of the constitution regulating the taking of private property for private use. As the action was one to quiet title and not a proceeding to condemn, the supreme court held the decree of the trial court to be erroneous in this respect. The constitutional provision regarding preference uses seems, therefore, to apply to the right of condemnation only.

Idaho, in 1903, adopted legislation providing for applications to the state engineer by those wishing to appropriate water. On the approval of an application a "permit" is issued which fixes the amount of water to be appropriated, the time within which construction work must be started, the time for completion of construction work and the time for complete application of the water appropriated to beneficial use. After a showing that the water has been completely applied to beneficial use in accordance with the permit a license is issued. In the Basinger case it was held that a permit from the state engineer is not a water right but that it "merely expresses the consent of the state that the holder may acquire a water right, and if the holder of the permit substantially complies with all the requirements of the statute, to and including the actual application of the water to the beneficial use specified in the application for the permit, he may become the owner of a water right. * * *" The license, however, is held to be "prima facie evidence of a water right."

In re Sucker Creek, Oregon, 163 Pac. 430

Appropriation and Riparian Rights—Distinction in Oregon.—Under the procedure adopted in Oregon in 1909 for the determination of water rights, the state water board (composed of the state engineer and two division superintendents) up to March 1, 1917, had determined the water rights of 3664 claimants. Although a few of the number claimed riparian rights only one claimant was finally decreed a riparian right. In the Sucker Creek determination 45 claimants were before the board and all were satisfied with the resulting adjudication with the exception of one, Mary Ellen Leonard. On appeal Mrs. Leonard claimed riparian rights, but the supreme court held that as her claims before the water board were based upon prior appropriation it was too late to assert a claim of riparian rights. In the words of the court: "Repeated decisions have wedded this court to the doctrine that a settler upon a non-navigable stream has an election either to rely upon his rights as riparian proprietor, or to make an appropriation of the water, if it is subject to appropriation, and claim as an appropriator, but he cannot do both." This doctrine is, unfortunately, not followed in California.

In commenting on the measure of a right by prior appropriation and one by riparian ownership the court said: "The right of prior appropriation can be measured by a fixed rule, and the amount of water can be definitely determined, but the exact quantity of water which a riparian proprietor is entitled to use for irrigation cannot ordinarily be ascertained in advance, for the reason that the right of each must be exercised in subordination to that of all the others."

LARGEST MOTORSHIP THROUGH THE CANAL.

The motorship George Washington of the Norway-Pacific Line (Fred Olsen, operator), which passed through the Canal on December 22, is under charter to the government to carry coal from Norfolk to Tiburon. On her first trip in this service the ship carried 9121 tons of coal. She is 445 ft. in length by 55 ft. beam and was drawing 26 ft. 9 inches at time of transit. This is the largest motorship which has passed through the Canal. The Chile, which made the transit on July 31, 1916, has a length of 445 ft. and beam of 53 ft.; her canal tonnage is slightly less than the George Washington's.

The largest cargo which has been carried through by a motorship was 9200 tons, that of the Falstria, which made the transit on June 30, 1916.

SUGGESTIONS FOR CONTRACTOR AND DEALER

DEPARTMENT CONDUCTED BY GEORGE A SCHNEIDER

(On account of the enormous number of storage cells now being installed for isolated lighting plants, signaling purposes and the like this article on protective devices for storage battery charging plants is particularly opportune at this time. It is written especially for the electrical dealer or contractor but should be of interest to industrial plants, electricians or others who are called upon to select devices of this kind. The information will undoubtedly prove useful for those having in charge the electrification of army cantonments. The author is power apparatus specialist for a well-known electrical supply house in San Francisco.—The Editor.)

PROTECTIVE DEVICES FOR STORAGE BATTERY CHARGING CIRCUITS

Protective devices for this service may be classified as follows:

(a) Plain underload, or combined underload and overload circuit breakers, having series winding only.
(b) Automatic cut-outs having both series and potential windings.
(c) Low-voltage and reverse current circuit breakers, having both series and potential windings.
(d) Automatic cut-out having alternating current potential winding only.

This is not a complete classification of all the types that are possible, but covers practically all of the devices that are used in connection with small storage battery lighting plants or generator sets for battery charging service.

The plain underload breaker was illustrated and described in the last issue of the Journal of Electricity. As was pointed out, the disadvantage of this type for certain classes of work is that it must be manually closed after having opened either due to underload or complete failure of the charging circuit.

An automatic cut-out switch of the type covered by paragraph (b) in the classification given is illustrated in Fig. 1. The function of this switch is to automatically connect the charging circuit with the battery circuit whenever the voltage of the charging circuit is high enough to charge the batteries and to automatically break or "cut out" the charging circuit when the voltage is too low—that is when there is a reverse current from the battery to the charging circuit.

Fig. 1. Automatic Cut-out for Constant Voltage Service

This cut-out switch consists of a disc shaped contact plate attached to a movable core, a set of stationary contacts and the necessary solenoid windings completely enclosed in a suitable casing. The internal connections are shown in Fig. 2. There are two windings—a shunt or potential winding connected directly across the generator terminals and a series or current winding connected in series with the battery circuit or load.

When the voltage of the generator is equal to the voltage for which the cut-out has been adjusted to operate, the current flowing through the potential winding will cause the solenoid core to rise and thus close the switch contacts. It will do this whether or not the battery circuit is connected. If the battery circuit is completed by the closing of the cut-out contacts, the series winding at once comes into action, assisting the potential winding in holding the contacts closed.

The pull exerted by the series winding is proportional to the charging current and therefore tends to hold the contacts more firmly closed as the current increases. This is a desirable feature as it prevents overheating or burning due to poor contact between the switch contacts.

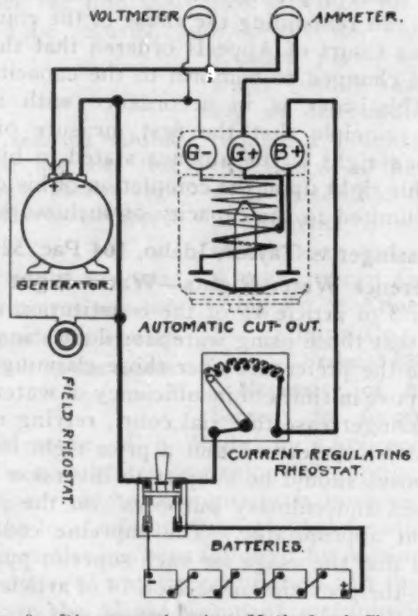


Fig. 2. Diagram showing Method of Charging Batteries with Constant Generator Voltage

Should the power driving the generator fail or the voltage of the generator fall below a certain value, current from the battery will flow through the series winding of the cut-out in a reverse direction into the generator, thereby neutralizing the effect of the potential winding and allowing the switch to open by gravity but the switch will again automatically close when the conditions are restored to normal. Only a small reverse current is required to open the switch so the contacts are always broken under practically no load conditions. This type of cut-out will give complete protection against reverse current and low voltage.

In selecting switches of this design for isolated lighting plants it is necessary to know the ampere capacity required, the number of cells to be charged

in series and whether the cells are of the lead plate or Edison type. The number of cells and their kind will determine the voltage for which the potential coil must be wound and the cut-in voltage for the switch. The cut-in voltage adopted by one of the leading manufacturers of these devices is as follows:

32 volt system, 16 lead cells in series, 38- 40 volts.
65 volt system, 32 lead cells in series, 78- 80 volts.
110 volt system, 56 lead cells in series, 138-140 volts.
110 volt system, 56 lead cells charged in two parallel groups of 28 cells each and discharged in series, 106-108 volts.

In battery charging service stations the number of cells on charge will vary and the type of cut-out will depend on whether or not the generator is operated at practically constant voltage or at a voltage varying with the number of cells. The particular cut-out so far described is suitable only for those installations employing constant generator voltage. This method of charging is outlined in Fig. 2. As will be noted, an external battery charging rheostat is employed to regulate the charging rate according to the size of cells under charge. The automatic cut-out is connected between the generator and the regulating rheostat, at which point the voltage is constant without reference to the number of batteries on charge. The cut-out can therefore be adjusted for this fixed generator voltage. It would be set to cut in at slightly lower than the operating voltage of the generator.

There are some battery charging outfits—mostly motor-generator sets—having generators especially designed for this service. With these outfits no external regulating rheostat is necessary as the voltage delivered by the generator can be varied within wide limits, this voltage being determined by the maximum number of batteries to be charged in series at one time. For example if two 6-volt batteries are to be charged, the field rheostat is adjusted so that the generator will deliver approximately 15 volts; likewise if four 6-volt batteries are to be charged the generator is adjusted for about 30 volts. For these conditions a switch designed to cut in at a fixed generator voltage would, of course, not be satisfactory for if adjusted for 30 volts, for example, it would not cut in when the generator voltage was lowered to 15. It would therefore not protect the battery.

By slight modification the type of cut-out used for constant voltage service can be arranged for variable voltage service. This modification consists of inserting a resistor in series with the shunt or potential coil of the switch, with a means of varying the resistance and therefore the cutting-in voltage, according to the number of batteries to be charged. This is accomplished by a switch which is operated by means of a button handle on the front of the cut-out. A dial and pointer are provided to indicate the position of the switch. These special features are illustrated in Fig. 3. This pointer is set at points 1, 2, 3 or 4, depending on the number of 6-volt batteries it is desired to charge in series. The equivalent in 12-volt batteries can also be charged. For example, to charge two 12-volt batteries the pointer would be set at 4 and so on.

The operation of the switch is not in any way effected by adding the series resistor. At any of these settings the switch will open on a very small reverse current. It will also automatically cut in or close the circuit when normal conditions are restored.

These cut-outs are especially useful in connection with motor-generator sets for by using them charging can be done day or night with absolute safety and without the presence of an attendant. Most small motor-generator sets are equipped with polyphase motors or with single-phase motors of a type that do not require any external starting devices. In case of failure in the line voltage the motors will stop but will start up when the supply voltage is again restored. The cut-out will protect the batteries and restore the charging current at the proper time. Further with reverse current and low-voltage cut-outs there is not any danger of the polarity of a compound-wound generator being reversed so that it will generate in a reverse direction and injure the battery plates when the power comes back on the line. By selecting cut-outs of the proper ampere rating, any number of battery circuits can be charged in multiple, providing the generator is of sufficient capacity.

Fig. 3. Automatic Cut-out for Variable Voltage Service

The low-voltage and reverse current circuit breakers listed under paragraph (c) give the same degree of protection as the automatic switches just described but will not automatically close. After having opened these breakers will remain so until manually closed.

So far in this discussion only those protective devices which operate on direct current have been mentioned. With motor-generator sets, it is also possible to use a form of protective device that is connected both with the alternating and direct-current side of the set. One form of device used for this purpose consists of an alternating current relay or contactor having the operating coil connected directly across the line supplying the motor and a set of switch contacts in series with the battery circuit. The alternating and direct-current parts are of course insulated from each other. When the alternating voltage fails, the relay opens the battery circuit and when the circuit is again restored closes the battery circuit. Its action is automatic just as are the switches already described.

FRANK SOMERS, President of the California Association of Electrical Contractors and Dealers. Witty and nerved to keenest action, Colonel Somers, as the presiding genius of the convention, won the admiration and good will of all beholders.

H. F. JACKSON, President and General Manager of the Sierra & San Francisco Power Company, and President of the Pacific Coast Section N. E. L. A. The workers of the convention were vividly taken back to the delightful days at Riverside as Captain Jackson pictured the beautiful and effective work of the Pacific Coast Section N. E. L. A. and reminded his hearers of their eligibility to membership in that organization. The increasing desire of central stations to go out of the business of retailing of appliances was also brought out and the convention responded with unusual enthusiasm when allusion was made to the growing confidence that is felt among central station managers in the ability of the contractors and dealers to handle their own problems and the growing willingness of the central station to withdraw from this conflicting field of endeavor.

CALIFORNIA ELECTRICAL CONTR

A NOTEWORTHY CONTRIBUTION TO INDUSTRY THE W

The convention of the California Electrical Contractors' Association held at Santa Cruz, July 11-14, 1917, added a distinct contribution to the advance of the electrical industry in the West. The convention was a notable one from every view point. Not only was it the largest in the history of the association but the character of papers read and the wide discussion, largely participated in not only by electrical contractors but by manufacturers, manufacturers' agents, jobbers, central station men and other representative men of the electrical industry throughout the West.

The paper of H. A. Lemmon on newspaper advertising was of exceptionally high order, as also were those of H. C. Reid on business phases of electrical constracting and dealing, Louis Levy on retailing and merchandising, and C. F. Butte on the diversified problems of electrical contracting. Two of these papers appear in full in this issue of the Journal of Electricity. The other two will appear in the issue of August 1, 1917.

Many other helpful papers were presented at this convention among which should be mentioned the papers of W. H. Gribble of Chico on merchandising and Professor C. C. Staehling on accounting.

The afternoon session, devoted to the problems that deal with the electrical industry as a whole, brought out an unusually spirited discussion by men of the electrical industry. The crux of this discussion is summarized with the captions that appear on this page under the photographs of a number of the men that took part in this symposium.

The social gatherings and banquet were well attended and men of the industry were drawn closer in touch by the many informal occasions that presented themselves for personal contact with each other. Albert Elliott, secretary of the Pacific Coast Electrical Supply Jobbers' Association, gave a masterful address at the banquet on present world conditions. Samuel A. Chase, assistant to the manager of the Supply Department of the Westinghouse Electrical Manufacturing Company, in a few fitting remarks, brought greetings from the East, while Tracy Bibbins, president of the Pacific States Electric Company, responded to the call of Toastmaster Somers by a well-chosen story. But the hit of the banquet took place some minutes previous to this when one of the entertainers gracefully chose Mr. Bibbins as the most dignified banquetter of the evening and introduced him, much to the enjoyment of those present, to some new ideas in the terpsichorean art. Many other pleasing incidents happened at this convention, not the least of which may be recalled the experience of C. B. Kenny in operating the elevator of the Casa del Rey at three o'clock in the morning.

CARL E. HEISE, Western Manager of the Westinghouse Electric & Manufacturing Co. In handling the delicate subject as to why manufacturers must, for some lines of apparatus, maintain an effective sales service, and not turn the work over to the jobber, or dealer, Mr. Heise presented his points so clearly and so fairly that a much stronger spirit of co-operation and a clearer understanding between contractor dealer and manufacturer must perforce result in the future.

W. S. BERRY, Western Salesmanager Western Electric Company. In his characteristically helpful manner Mr. Berry brought out a new idea, the study and practice of which will undoubtedly vastly forward the substantial financial footing of the electrical contractor in the West by putting into application bids similar to the Nelson Form for choosing bidders and awarding contracts as now so effectively in vogue in certain eastern centers.

R. M. ALVORD, Supply Manager San Francisco office General Electric Company, and President of the San Francisco Electrical Development and Jovian League. In discussing the paper on the diversified problems of electrical contracting, Mr. Alvord struck the keynote of the convention best expressed in his own words: "We profit as we serve."

PRINT IN BINDING

L CONTRACTORS' CONVENTION

ITRIBUTION TO THE ELECTRICAL
USTRY OF THE WEST

To M. A. De Lew must be given much of the credit for the splendid manner in which the convention as a whole was scheduled. In appreciation of his excellent services, the convention presented him with a handsome gladstone bag at the banquet. To Mrs. Frank Somers a beautiful gift was given in appreciation of the unselfish manner in which the ladies had throughout the year assisted the husbands of the association in the good work for the convention.

The kindly co-operative work of the central station men represented at this convention was exceptionally noticeable, practically all of the larger power companies participating, as may be gleaned from the prominent array of names that appear in the register under the heading of central stations.

The new officers of the association and attendance at the convention were in detail as follows:

President—H. C. Reid, San Francisco. Secy-Treas.—J. W. Redpath, San Francisco.

Executive Committee

M. A. De Lew, T. J. Bennett, San Francisco; R. Oyler, J. Gensler, Oakland; R. Goold, Stockton; W. E. Hayes, Santa Rosa; C. E. Turner, Sacramento; R. F. Ryan, Redwood City; W. E. Cox, Santa Cruz; H. H. Courtright, Fresno; G. E. Arbogast, Los Angeles.

Stockton

C. D. Bass and wife, Com'l Elec. Co.
M. W. Hild and wife, Elec. Mach. & E. Co.
A. F. Flanagan and wife, Elec. Eng. & Sup. Co.
H. V. Dobson.
R. Goold and wife, Goold & Johns.
C. J. Franke and wife.
B. Vancott.
Miss Mitchell.
C. O. Gould, Gould the Light Man.

San Mateo

W. G. Loveland.
S. Cohn, Atlas Electric.
J. A. Foster.

San Joaquin Valley

Geo. Delano, Cen. Cal. Elec. Co., Lindsay.
H. H. Fenneman, United Elec. Co., Taft.
H. H. Courtright and wife, Valley Elec. Supply Co., Fresno.
H. W. Lewis and wife, Lewis Elec. Co., Fresno.
T. M. Robinson and wife.
E. E. Elzea and wife, Central States Elec. Co., Fresno.
H. C. Nutt, E. M. M. Service, Exeter and Lindsay.
S. E. Nutt.
T. H. Curry and wife.
J. A. Ulmer.

Santa Cruz

W. E. Cox and wife, Cox Elec. Co.
O. Johnson and wife, Cox Elec. Co.
M. A. Cain, Cain Elec. Co.
R. F. Geyer, City Electrician, Santa Cruz.
Miss C. F. Howe, guest.

Oakland

Hugh Kimball, Kimball Elec. Co.
J. Gensler and wife, Elec. Con. Co.
M. F. Nagle, Bay Elec. Co.
R. King and wife, King's Elec. Co.
A. A. Smith and wife, Berkeley
W. Bernhard and wife, Bradshaw Elec.
R. V. Oyler and wife, Capitol Elec. Co.
W. L. Mitick.
R. E. Conrad and wife.
Norman Ellis, Oakland Elec. Co.

Sacramento

C. V. Schneider and wife, Elec. Supply Co.
Miss E. Schmeiser.
J. C. Hobrecht, J. C. Hobrecht & Co.
F. T. Wallace, Nevada Elec. Co.
Mr. Brockway, Latourette-Fical Co.
J. A. Woods, Cal. Mech. & Elec. Eng. Co.

H. C. REID, the newly-elected President of the California Association of Electrical Contractors and Dealers. The earnest personality of Mr. Reid has long been felt for good in the affairs of the electrical industry and all well wishers of the association see in the year's administration ahead a term of unexampled usefulness under his wise and thoughtful supervision.

C. F. BUTTE, of the Butte Electric Co., San Francisco. Mr. Butte's paper on the diversified problems of electrical contracting brought out a series of interesting discussions that called into play representatives from all phases of the electrical industry, the result of which will forward still further the well-recognized spirit of co-operation among electrical men of the West.

DAVE HARRIS, Vice-President Pacific States Electric Company. That the greatest asset of the electrical contractor is confidence was forcefully brought out by Mr. Harris, who showed that confidence is to be gained by a true study of efficiency: "Efficiency founded on intelligence must become the keynote of our future business success."

ARTHUR KEMPSTON, Chief Electrician of the City of San Francisco. Mr. Kempston showed in his remarks how the spirit of co-operation among electrical men in the West had progressed from the idea of aloftness held by the inspector best summarized in the former words "Aw, go on kid, do it again and learn yourself," to that of the splendid spirit of unity and mutual helpfulness that now exists in all the work of the city electricians of the West.

ROBERT L. ELTRINGHAM, Electrical Engineer for the California Industrial Accident Commission. How the splendid work for safety in the industries of the West may be vastly forwarded by the spirit of co-operation was brought out by Mr. Eltringham, who forcefully stated that the law-abiding contractor who abhorred short-cuts in his work and looked toward the betterment of the elements of safety in the product of his hands would in the long run be the man that best bettered himself and that best advanced the standing of the industry as a whole.

THE CONTRACTORS' BABY DOLL.—Never before in its history could the contractor be said to have been more "aboard," heart and soul, than at the inspiring convention at Santa Cruz—inspiring not only to the contractor but to all men of the electrical industry that were present.

San Francisco

M. L. Scobey, Home Electrical.
W. J. Hemington, City Protective Elec. Co.
C. B. Kenny, Ne Page, McKenny Co.
P. F. Decker and wife, Decker El. Con. Co.
Mrs. Drew.
O. Kurtz, Electrical Contractor.
Mrs. C. D. Herbert.
G. D. F. Smith, Kohlwey, Smith & Alfs.
W. H. Kirsten.
C. F. Butte, Butte Eng. & Elec. Co.
B. J. Doherty.
W. D Kohlwey and wife, Kohlwey, Smith & Alfs.
E. W. Lauer, Rex Elec. Co.
C. Collonan, Collonan Elec. Co.
F. S. Thomas and wife.
Mrs. Hughes.
Louis Levy, wife and children, Levy Elec. Company.
J. W. Asher, Asher Elec. Co.
L. Asher, wife and niece.
Mr. Flatland, Globe Elec. Co.
E. E. Brown, H. S. Tittle Co.
T. J. Bennett, Rex Elec. Co.
M. A. De Lew and wife.
Miss Bernice De Lew.
C. J. Newbery, Newbery Elec. Co.
H. C. Reid and wife, Pacific Fire Ext. Co.
Miss Thurston.
C. L. Chamblin, Cal. Elec. Con. Co.
W. G. Stearns.
T. M. Stateler, Thomas Day Co.
C. S. Wolf and wife, Standard El. Con. Co.

San Jose

F. J. Somers and wife, Century Elec. Co.

Richmond

C. F. Renwick and wife, Pioneer Elec. Co.
Miss E. Renwick.
H. McDonald, Pac. Elec. & Mfg. Co.

Watsonville

John Stanovich and wife. J. Schambacher.

Lodi

B. A. Smith, Wallace & Smith.

San Luis Obispo

W. V. Fisk and wife.

Monterey

D. A. Noggle, Noggle Elec. Works.

Los Angeles

A. R. Pierce, Elec. Corp., Los Angeles.
J. P. Bowden.
B. W. Whipple.
F. O. Lantz.
H. B. Woodill, Woodill-Hultz Co.
C. Loveberg.
J. A. Newton.

Chico

W. H. Gribble and wife, West. Gas & Elec. App. Co.

Jobbers

T. E. Bibbins, Pacific States Elec. Co.
A. J. Lutz, Pacific States Elec. Co., S. F.
Geo. J. Drew, Pac. States El. Co., Oakland.
D. E. Harris and wife, Pacific States Elec. Co., S. F.
F. J. Airey, Pacific States Elec. Co., Los Angeles.
A. E. Skilecorn, Pacific States Elec. Co., Fresno.
R. F. McDonald, Holabird-Reynolds Co.
H. A. Sayles, Holabird-Reynolds Co.
W. D. Thomas, Elec. App. Co.
C. J. Winslow, Elec. App. Co.
A. Meinema, Elec. App. Co
F. J. Cram, Elec. App. Co.
W. L. Neelands, West. Elec. Co.
W. S. Berry, West. Elec. Co
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W. Todd, West. Elec. Co.
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D. J. Butts, Western Elec. Co.
C. C. Davis, Pacific Hardware & Steel Co.
C. E. Wiggin, D. C. & H. Co.
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H. H. Hoxie. Elec. Rys. & Mfrs. Sup. Co.
P. G. Gough.
A. P. Peck, Holabird-Reynolds, Sacramento.

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P. H. Affolter, Garland-Affolter Eng. Co.
R. M. Alvord and wife, Gen. Elec. Co.
C. F. Forsberg, Gen. Elec. Co.
F. E. Boyd, Gen. Elec. Co.
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F. D. Fagan, Edison Lamp Works.
T. W. Simpson, Federal Sign System.
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C. A. Gray, Crouse-Hinds Co.
J. W. Thompson, Johns-Manville Co.
S. P. Russell, Johns-Manville Co.
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M. F. Steel, Benjamin Elec. Co.
A. E. Rowe, Tel. Elec. Equip. Co.
Garnett Young, Tel Elec. Equip. Co.
I. J. Francis, Roebling & Sons .
F. A. Devlin, Roebling & Sons.
A. T. Brown, Roebling & Sons.
H. E. Sanderson, Bryant Elec. Co.
W. G. Stearns, Stan. Underground Cable Company.
F. G. Beck, American Everready.
Geo. A. Koch, American Everready.
J. A. Vandegrift and wife, Oakland Division Mazda Lamp Works.
C. R. Hunt, Robbins & Myers.
C. E. Heise and wife, West. Elec. & Mfg. Company.
S. A. Chase, West. Elec. & Mfg. Co.
E. M. Cutting, Edison Storage Battery & Supply Co.
C. D. Herbert, Westinghouse Elec. & Mfg. Company.
R. A. Balzari, Westinghouse Elec. & Mfg. Company.
Clark Baker, Oakland Div. Mazda Lamp Works.
R. Wolfsberg, Elec. Agencies.
B. A. Wagner, Elec. Agencies.
J. H. Jamison, Westinghouse Elec. & Mfg. Company.
W. R. Dunbar, Westinghouse Elec & Mfg. Company.
J. P. Hermans, Westinghouse Lamp Co.
S. B. Gregory and wife, Arrow Elec.
G. Battee, Bittman & Battee.
H. H. Hughes, Westinghouse Elec. & Mfg. Company.
J. H. Lavensen, Alexander & Lavensen.
Max Loewenthal, United Trading Co., San Francisco.
W. C. Wurfel, Westinghouse Lamp Co.
L. E. Sperry, N. Y. Ins. Wire Co.

Central Stations

S. V. Walton, P. G. & E. Co.
L. H. Newbert, P. G. & E. Co.
A. W. Childs, So. Cal. Edison Co.
H. A. Lemmon, Truckee River, G. E. Co.
H. P. Pitts and wife, P. G. & E. Co.
H. F. Jackson, Sierra & S. F. Power.
W. McKinley, Sierra & S. F. Power.
Chas. Northcutt, Sierra & S. F. Power Co.
L. E. Woodbridge, Sierra & S. F. Power Co.
N. F. Neiman and wife, Univ. Gas & Elec.
H. E. Grant, Universal Gas & Elec.
W. S. Leffler, Great Western Power Co.
E. B. Criddle, Southern Sierras Power Co.
A. W. Childs, So. Cal. Edison Co.
J. G. Pomeroy, So. Cal. Edison Co.

Miscellaneous Guests

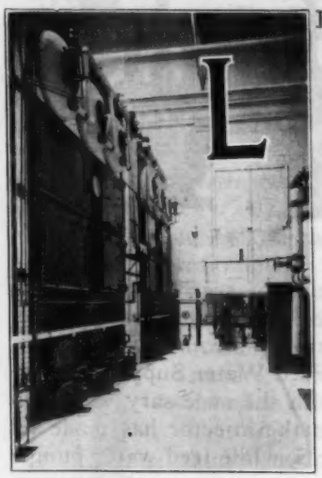
Robt. L. Eltringham and wife, California Industrial Accident Commission.
Albert H. Elliot and wife, Secretary Pacific Coast Elec. Sup. Jobbers.
A. Kempston, City Elec. Eng., S. F.
C. W. Mitchell, Elec. Eng., Pacific Board of Underwriters.
E. Brettell and wife, Vancouver, B. C., Electrical Contractor.
J. H. Sroufe, Portland, Elec. Contractor.
H. C. Rohrback and wife, Tacoma, Elec. Contractor.
J. F. Ne Page, Seattle, Ne Page, McKenny, Company.
C. C. Staehling, University of California.
R. Sibley, Journal of Electricity.
A. H. Halloran, Journal of Electricity.
J. W. Redpath and wife, Secretary California Contractors' Association.
H. A. Lemmon, T. R. Gen, Elec. Co., Reno, Nevada.
Mrs. Doran, entertainment committee, representing Santa Cruz. Cham. of Com.
R. L. Cardiff, entertainment committee, representing Coast Counties Gas & Elec. Co., Santa Cruz.
Miss Thurston, entertainment committee, representing Coast Counties Gas & Elec. Co., Santa Cruz.
Mrs. Pauline Lary, entertainment committee, Los Angeles.

FUEL OIL AND STEAM ENGINEERING

(Recent practice in fuel oil economy makes necessary a better understanding of the fundamental parts of the boiler shell and its accessories with especial reference to heat insulating and heat transmitting characteristics of the boiler shell. In this discussion the authors first establish the fundamental principles of steam generation, then the laws of heat transmission through the shell are set forth. The discussion concludes with a description of the leading accessories that go to make up the modern boiler equipment.—The Editor.)

THE BOILER SHELL AND ITS ACCESSORIES FOR STEAM GENERATION IN FUEL OIL PRACTICE

BY ROBERT SIBLEY AND CHAS. H. DELANY



The Clean, Clear Cut Appearance of the Oil Fired Boiler Room

LET us now consider some of the fundamental laws involved in heat transference, and then discuss the container or shell employed in steam generation together with the accessories that must accompany any high pressure steam generating unit to accomplish safe and efficient operation.

Going back once again to the homely tea-kettle for a simple illustration, we find that the container for the water and steam usually consists of a flat bottomed metallic vessel with free opening to allow the steam generated to escape to the atmosphere. There is also usually to be found an opening with a lid covering at the top where water may be passed in or the vessel cleaned at more or less irregular periods of operation in household economies.

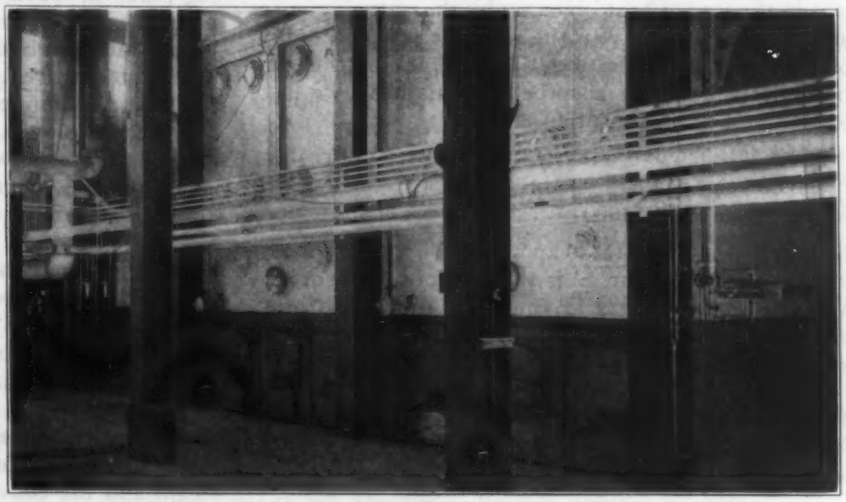
In the case of the steam boiler, however, vast improvements in physical configuration and construction become a necessity. Let us then examine some of these differences.

The Laws of Heat Involved in Steam Generation.—The transference of heat is found by experimental observation to take place in three separate and distinct ways—namely by conduction, by radiation, and by convection.

On a wintry night if one stands in front of a blazing fireplace it is easy to find illustrations of those three methods of heat transference. Thus standing, one feels the heat radiating to his face in outward projections from the fire, for if an article such as a solid screen, opaque to heat radiation, be placed between the face and the fire the sensation of heat on the face immediately disappears. If now from behind the screen one holds a metallic poker in the hot fire, it will not be long before the poker even at the point behind the screen becomes so hot by conduction that it cannot comfortably be held in the hand. And finally should a sudden gust of wind blow down the chimney a hot gust of air may be driven out into the room and around the screen to the observer's face, thus illustrating the transference of heat by convection.

The Principle of Operation of the Steam Boiler.—Let us then see how these three methods of heat transfer are utilized in modern boiler operation.

As has been previously noted, the burning of the fuel in the furnace causes enormous quantities of heat to be given out in the furnace space. This heat is immediately absorbed by the furnace gases, thereby raising them to a high temperature. By convection currents, and also by radiation, this heat is now transferred to the outer surface of the boiler shell and tubes containing the water that it is desired to convert into steam. The metallic shell and water tubes having now absorbed the heat, convey it to their inner surface by conduction where it is transferred to the water in the boiler. This water, becoming heated, expands, and, due to its lighter density thus created is



A NEW ADVANCE IN OIL FIRED BOILER ACCESSORIES

Here is a picture of the boiler fronts of the new Bush street station of the Great Western Power Company, described in the Journal of Electricity, July 15, 1917. Note the master controller, the automatic regulator at the burner, the regulator for the ash pit and damper control, and the piping arrangement that crosses the boiler points, all of which are utilized in securing an economic control of the burning of oil with its proper mixture of air. Such illustrations as this indicate the delicate control under which recent advances in fuel oil economy have made the operation of the modern oil fired boiler a mechanism of extreme sensitiveness.

forced to go to the top of the water surface to make way for cooler, heavier water which in turn absorbs heat and disappears to make way for other water. This last activity is evidently again transference by convection currents and such a movement of water is called circulation. The efficient manner in which this circulation takes place has much to do with the economic operation of the boiler.

Mathematical Equation for Heat Transference.—In 1909 Dr. Wilhelm Nusselt of Germany devised a formula whereby the factors involved in the rate of transference of heat are set forth quantitatively. This formula reduced to English units by the Babcock and Wilcox Company in their book on Steam is as follows:

$$a = 0.0255 \frac{\lambda_w}{(d)^{.214}} \frac{(Wc_p)^{.786}}{(A\lambda)} \quad \ldots\ldots\ldots\ldots (1)$$

Wherein a is the transfer rate in B.t.u. per square foot of surface per degree difference in temperature; W is the weight of pounds of the gas flowing through the tubes per hour; A is the area of the tube in square feet, d is the diameter of the tube in feet; c_p is the specific heat of the gas at constant pressure; λ is the conductivity of the gas at the mean temperature and pressure in B.t.u. per hour per square foot of surface per degree Fahrenheit drop in temperature per foot; and λ_w is the conductivity of the steam at the temperature of the wall of the tube.

Mathematical Law for Total Heat Absorption.—The application of this formula is cumbersome and indeed upon careful analysis it is seen to be largely empirical in its nature. Let us then cast about for another equation.

Stefan's law sets forth that the heat absorbed per hour by radiation is proportional to the difference of the fourth powers of the absolute temperature of the furnace gases T and the absolute temperature of the tube surface t of the boiler. In addition to this if we add the loss of heat given up by the outgoing gases due to their cooling from the absolute temperature T_1 to the absolute temperature T_2 on the assumption that the boiler tubes have absorbed all this heat, we have for the total heat absorption

$$E = 1600 \left[\left(\frac{T}{1000}\right)^4 - \left(\frac{t}{1000}\right)^4 \right] S^1 + WC(T_1 - T_2) \ldots (2)$$

In which E is the total evaporation of a boiler measured in B.t.u. per hour, S^1 is the area of boiler surface, W is the weight of gas leaving the furnace and passing through the setting per hour, and C is the specific heat of the gas.

Relationship of Rate of Heat Transfer.—By means of the integral calculus it may now be found from the above equation that the rate of heat transfer R may be expressed by the equation

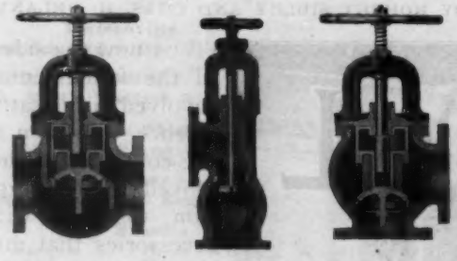
$$R = \frac{WC}{S} \log_e \frac{(T_1 - t)}{(T_2 - t)} \quad \ldots\ldots\ldots\ldots (3)$$

This law shows an important relationship of temperatures whereby we may design condenser shells as well as boiler shells to accomplish a maximum rate of heat transfer.

In the Babcock and Wilcox type of boiler the constants involved in heat transference have been quite accurately ascertained. By substituting these constants the above equation is found to reduce to the simple relationship:

$$R = 2.00 - .0014 \frac{W}{A} \quad \ldots\ldots\ldots\ldots (4)$$

Necessity for Boiler Accessories.—Since the modern boiler operates under pressures and temperatures far in excess of the tea-kettle and since the quantities of water involved are far beyond hand operation,



Stop, Check, and Blow-off Valves

the necessity for the creation of accessories to properly care for these increased responsibilities early became apparent in the evolution of steam engineering.

Injector or Pump for Feed Water Supply.—In order to supply the boiler with the necessary water involved in steam generation the injector has made its appearance in some instances, while feed-water pumps are used in other instances.

Since the modern boiler operates at from 100 to 275 lb. pressure per sq. in., it is evident that the water must be forced into the boiler, for no ordinary water supply is obtainable to meet such adverse pressures.

The type of pump most frequently met with for boiler feed purposes is the ordinary duplex double acting pump in which the steam cylinder is made larger than the water cylinder to enable the water to be forced into the boiler at a pressure greater than that of the steam itself. Pumps of this type are very reliable and if chosen of sufficient size so they can be operated at slow speed give excellent satisfaction.

For large power plants the centrifugal pump is coming into favor owing to the small space it occupies and the small attendance required. It is built in four, five or six stages, depending on the water pressure required, and may be driven by either an electric motor or a small steam turbine.

The operation of the injector is accomplished by drawing a certain amount of steam from the boiler and allowing it to attain an enormous velocity. This steam then comes in contact with the feed water supply which at once converts this impinging steam into water. The immense impetus of the outflowing steam and the conversion of the latent energy of this steam into kinetic energy of motion causes the feed water to be sucked in and driven against the check valves of the boiler with such force as to overcome the opposing pressure and allow such water to enter as may be needed.

The injector is limited in its field of operation by the fact that the water must be cold enough to con-

dense the injected steam—in other words the injector cannot pump hot water. As the hotter the feed water the more economical the plant the injector is only suitable in plants where there is no hot water available. This condition exists on the locomotive where the injector finds its greatest usefulness.

Check and Non-Return Valves.—In order that no water should flow back out through the entrance valve, some means must be provided. Many types of valve are used in practice to perform this function. An illustration of a typical type of check valve is shown in the picture exhibited herewith.

Pet Cocks for Water Level

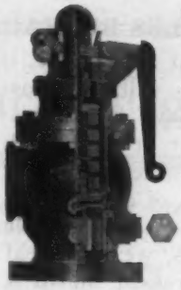
The Steam Gage and the Water Gage.—In the operation of the tea-kettle the escaping of the steam into the atmosphere readily prevents the possibility of explosion, and the ever watchful eye of the attendant is utilized to see to it that the water supply is sufficient for safe operation. The use of high pressures and inclosed boiler shells makes it imperative in steam engineering to have some means of ascertaining the pressure under which the boiler is operating and to determine the height of the water in the boiler shell. The steam gage meets the former requirement. This type of instrument was described in the chapter on pressures.

A Safety Gauge

To ascertain the water level in the boiler shell, the installation of water columns enclosed in glass tubes makes visible the height of the water in the boiler. The water column is located so that its center is at about the proper height of water in the boiler. The upper end of the column is connected to the steam space of the boiler and the lower end to the water space, so that the water in the column always rises to the same height as the water in the boiler. The bottom of the glass must be a little higher than the lowest level at which it is safe to carry the water to prevent damage by overheating the sheets or tubes, and the top of the glass must be a little lower than the level at which water would begin to be lifted and carried out with the steam. Pet-cocks are provided so that the water column may be cleaned of sediment at frequent intervals to insure its safe and accurate operation. Since the ascertaining of the exact water height in the boiler is of such vast importance, three additional pet-cocks called Gage Cocks are usually installed near the water glass. One of these is located above the proper water level, the second at about the water level, and the third below it. Hence, upon trial if the boiler is properly operating, the first should emit colorless dry saturated steam, the second water vapor and the third hot water.

Siphon for Keeping Steam Gauge Dry

Safety Valve.—All boilers are definitely standardized so that steam generation must not exceed a certain pressure development. To prevent this excessive generation of pressure a safety valve is always installed. These are in general of two types, the one having its outlet to the outside air controlled by a spring set for the pressure desired, the other controlled by a weight and lever arm set for the blow-off pressure desired. Since the total pressure required to open the valve equals its area in square inches times the pressure in pounds per square inch the compression in the spring or the weight on the lever may be determined in advance for any desired pressure in the boiler.



Pop Safety Valve

Manholes.—To clean and examine the boiler interior some means must be provided by which access may be had to its interior. On all modern types of boilers will be found man-holes and hand-holes whereby this access may be obtained when occasion arises.

Provision for Expansion.—The excessive temperatures under which a boiler operates and the sudden change from one temperature to another make it absolutely imperative that some means be provided to take care of uneven expansion in its parts. Most boilers on the market do not for this reason allow the boiler shell to rest upon the furnace structure, but on the other hand the boiler is suspended from above and all suspended parts are allowed to swing free with ample clearance between them and the brickwork. The care with which uneven expansion and its disastrous results are provided for makes much for efficient boiler design.

The Mud Drum.—Since all water contains a certain amount of impurities, some space must be set aside for the collection and segregation of these impurities. Such a compartment is known as the mud drum. This is cleansed at definite periods by blowing down the boiler, that is by opening the blow-off valve at the bottom of the mud drum and allowing some of the water to escape from the boiler into the atmosphere.

Having now a general ground work of boiler shell characteristics in their relation to heat transfer, and bearing in mind the accessories that must accompany the modern boiler, we shall next consider the commercial type of boiler and its classification.

Perhaps an imitation of some of Brazil's up-to-date methods would bring Americans to an every day use of the metric system. The city of Pernambuco, Brazil, is at present installing a new system of street numbering. It appears to be simple and practical and an improvement over the old system of numbering. To explain briefly, if the number of a house is 134, for example, then the number on that particular house is 134 meters from a certain starting point. The house across the street would be 135 meters or the nearest number to the actual distance from the starting point. The system is being used in several cities in southern Brazil, having been first tried in the city of Bello Horizonte.

N. E. L. A. DONT'S FOR THE SALES BUREAU

Taking up the subject of personal appearance, it would be poor policy for the solicitor to call on a prospective customer with two or three days' beard bristling on his chin in a belligerent manner. It would look as though he would give a customer's order very poor attention should his shoes be in need of a 5-cent investment of elbow-grease. While it is not possible for all of us to wear excellent clothes, we should at least be able to have them properly pressed, and it is only a small matter of 3 cents a day to have our collar fresh and clean every morning and it is not absolutely necessary to go to a manicure parlor to have the daily accumulation removed from one's finger nails.

I am a great believer in personal appearance and the impression made by the initial call. You can readily see that it would be very unfortunate for the salesman to appear to have neglected to comb his hair or to allow his teeth to get into such a condition that their offensive appearance would distract the mind of the prospective customer from the subject the salesman was talking about, and these many details if properly looked after will very often change a mediocre to a fairly good salesman.

Don't at any time become "fresh" with your customer, as his natural politeness may lead you to believe that he has not noticed it. You can rest assured, if you could see his mind, you would know that he resented it.

Don't under any circumstances use profane language to emphasize your point.

Don't think that it is necessary for you to entertain him by telling obscene stories. These are unnecessary and in bad taste.

Don't be servile in your attitude or language, but don't be curt to the point of being discourteous.

Don't forget that the customer, particularly when he is older than yourself, is entitled to the title of "Mr."—as you will in this manner no doubt be able at a later date to become well enough acquainted to eliminate it without losing any prestige.

Don't under any circumstances start to speak while your prospective customer is talking to you, as you will immediately give him the impression that you are paying no attention to what he is saying but are thinking only of your own selfish purpose.

Don't blurt out something without first thinking how it will sound, as words once dropped from the lips cannot be recalled.

Don't drink intoxicating liquor while on duty. I am not a temperance crank myself, but I very much object to getting the drink almost second-hand. By this I mean, the salesman in talking to the customer sometimes gets close enough so that his breath if charged with alcohol would be quite noticeable and objectionable. This also goes for onions and chewing tobacco.

Don't think that it is necessary when you come into a man's office to hitch your chair up so close to him that you make him feel like moving back from his desk.

Don't under any circumstances feel that it is necessary for you to emphasize your point by tapping him on the arm, or, if you are sitting close, tapping him on the knee, or laying your hands on him in any manner. If you must gesticulate like a wind-mill to emphasize your argument confine your actions to the use of a lead pencil, and if you are talking from a report, you can very easily tap on the item question without making it offensive.

Don't mistake your customer's desk for a hat rack, and don't under any circumstances call on a customer without first throwing away your cigar or cigarette.

Don't force yourself in to see a customer no matter how important you think it may be when he has as the case may be; and until you are fairly well acquainted with a customer it is not necessary to offer him a cigar; and I consider it extremely inadvisable to ask a customer during business hours to have a drink. said very emphatically that he does not wish to see you that day. This is a point where it rests with the salesman's judgment. In some cases it may be well to force the call, but in many cases it would be much better to keep persistently calling and studying the prospect's disposition so that you will be able to grasp the opportune moment.

To close this article, a little word of caution may be added to keep some enthusiastic salesman from talking himself out of an order. There is a point where the customer is willing to place his name on the dotted line and there is a point just beyond that at which either your appearance, speech or actions will cause him to change his mind. I have given a few of the lessons that each one of us must study carefully to see how we can eliminate our faults.

THE GREATEST GAS WELL FIRE IN HISTORY

The greatest gas well fire in history after burning nearly a quarter of a billion cubic feet at a loss of four and one-half million dollars in five and one-half days, was recently put out by Deputy Chief William Guerin, of the New York Fire Department, in five minutes.

The well is located seventeen miles west of Monroe, La., and is owned by the Ouchita Natural Gas & Oil Company. It had been flowing at the rate of 44,000,000 cubic feet a day under a head pressure of 1500 lb. to the square inch.

In describing the work Mr. Guerin said:

"After looking over the situation I decided that the problem was exactly the same as one that I had faced in the New York Fire Department. The only difference was one of degree

---

MAMMOTH TUNNELS OF HETCH HETCHY OPEN TO BIDS

City Engineer O'Shaughnessy has sent from Hetch Hetchy the plans and specifications for eighteen and a half miles of Hetch Hetchy tunnels, which it is estimated, will cost $6,200,000.

While the bonds have not been sold to pay for the work, indications have made the administration hopeful that the money will be on hand by the time the contracts have been awarded.

One of the tunnels will rank among the longest in the world, being slightly over 14 miles in length. There are two tunnels making up the eighteen miles that will be worked in three sections.

The inside dimensions of the tunnels will be in the shape of a horseshoe, 10 ft. 3 in. high and 10 ft. 3 in. wide. It is expected that the work will take approximately two years.

SPARKS—Current Facts, Figures and Fancy

(The stress of world conditions thrust upon America has made necessary the putting under of vast agricultural acreages hitherto unattempted. In England a movement is afoot to bring the electric plough into its own. The vast areas of the West served by hydroelectric power offer opportunities in a favorable light encountered nowhere else in the world for the supplying of electricity to the farm. Notations on the electric plough and other comment of present day status of the electrical industry may be gleaned on this page.—The Editor.)

Electricity took another step forward recently when the giant electrically propelled battleship New Mexico was launched from the New York Navy Yard.

* * *

As a little side light on road building behind the lines of the allies in France it may be stated that fifty thousand tons of stone weekly are required to mend the roads.

* * *

Even the "wise men" in the East must now admit the profitable side of irrigation. An irrigated acre in New Jersey recently brought forth twenty-one hundred dollars in produce.

* * *

According to Professor Elihu Thompson, a past president of the American Institute of Electrical Engineers, success in life is won by enthusiasm and the habit of constant thought.

* * *

Within recent years the efficiency of the electric motor has been gradually increasing until today these efficiencies run from eighty-three per cent in the fractional horsepower to ninety-three per cent in the large motors.

* * *

The increasing necessity that the American engineer familiarize himself with the metric system due to new world conditions thrust upon him is evident on all sides. Can you think in hectares, kilometers and grams? Better practice up.

* * *

The Mississippi River Power Company at Keokuk, Iowa, has installed the largest graphic meter in the world. The meter has a capacity of a quarter of a million kilowatts and draws the output curve of the entire station on a single chart.

* * *

The West may now claim a new record. The general public served by one of its great hydroelectric institutions—The Pacific Gas & Electric Company—is a greater holder of stock quantitatively and numerically than any other district served by a utility company in America.

* * *

An instance of the unprecedented proportions to which electricity has risen in the shipbuilding of the nation is that of the recent investment of twenty million dollars by the Bethlehem Steel Company in electrically operated steel and shipbuilding plants for the United States government and its allies.

* * *

A movement is on foot in England to speed up the use of the electrical plow. It would seem that our great hydroelectric companies of the West have been extremely backward in this regard as untold opportunities await the efficient evolution of the electrical plough in this section where such gigantic water powers are available.

* * *

The ranks of filmdom's stars have a new recruit—the Imperial Valley canteloupe. Moving pictures, electrically operated, showing the extent of the new industry, and the extraordinary care taken in seeing that the melons are carefully transported to all portions of America, have been taken, and will shortly be shown all over the country.

* * *

Electricity is playing a leading role in the gigantic shipbuilding that is now under way on the Pacific Coast. The application of electric power to overhead traveling cranes, aerial handling systems, circular cranes, shop machinery, cable conveyors, and for lighting shops and yards, represent the best practice and embody many features of special interest.

* * *

Kipling says: "When the waters were dried and the earth did appear, The Lord He created the Engineer." It was not until recently, however, that the electrically operated pump has made possible the return of these waters to the earth at proper intervals and thus perfect the grandest piece of creative work yet accomplished by man—the modern intensively cultivated farm in the West.

* * *

According to experts of the United States government, the country is at present not supplying 10 per cent of the platinum it requires. It has been urged that platinum dealers and producers inform the government fully regarding the available reserves of this highly important metal, as a patriotic duty. As a "war metal" platinum becomes particularly important in the manufacture of sulphuric acid and chemical utensils, both of which have a direct bearing on the production of high explosives and other necessary war supplies.

* * *

Among the many ultra-modern appliances of the great Southern Pacific Building in San Francisco which make the new office structure a model of its kind, is a pneumatic tube delivery system modeled on the lines of a telephone exchange. If a clerk in the department of freight accounts desires to refer a way bill to a special accountant four floors above him, instead of summoning an office boy, he puts the way bill in a mailing carrier, dispatches it to "central" and the latter after glancing at the destination shown on the indicator, shoots it to the proper office, all in the space of a few seconds.

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CONTENTS

A Successful Electric Truck Delivery Service. *By F. D. Weber* 97
Radiation Correction for Throttling Calorimeter 99
Diversified Problems of Contractor and Dealer. *By C. F. Butte* 100
Is the Regulation of Public Utilities a Success? 103
Electricity Supreme in Gold Dredging 104
Retailing and Merchandising. *By Louis Levy* 106
Pumping Plants of the U. S. Reclamation Service. *By S. T. Harding* 106
The Bonus, Water Right Value, and Appreciation. *By C. E. Grunsky* 111
Types of Practical Heat Insulation. *By John Crawford, Jr.* 114
New Law for Elevator Inspection 116
Short Journeys in Pacific Lands 117
Problems and Solutions 118
- Recent Water Legislation Introduced in Congress. *By John A. Britton.*
- Recent Fuse Practice for 2300 Volt Circuits. *By D. J. Butts.*
- Electric Load Advantages of a Wood Pulp Paper Mill. *By J. W. Hungate.*
- Advantages of Grounding Secondaries. *By C. E. Young.*

Recent Cases Relating to the Appropriation of Water. *By A. E. Chandler* 120
Protective Devices for Storage Battery Charging Circuits. *By George A. Schneider* 122
Convention of California Electrical Contractors Assn 124
The Boiler Shell and its Accessories for Steam Generation in Fuel Oil Practice. *By Robert Sibley* and *Chas. H. Delany* 127
N. E. L. A. Donts for the Sales Bureau 130
Mammoth Tunnels of Hetch Hetchy Open to Bids 130
Sparks—Current Facts, Figures and Fancy 131
Editorials 132
Personals 135
Trade Notes 136
A Tribute to a Western Pioneer in Engineering 137
Meeting Notices for Electrical Men 138
Latest in Everything Electrical 139
A Comprehensive Review of Recent Bulletins 140
What Western Inventors are Doing 142
New Electrical Developments 143

THE REWARD

It is well to remember in these days of tense activity that whether the engineer wears the regalia of the officer in the engineer corps, whether he serves as the executive of a great utility or whether his portion of life is but that of most of us simple folk, the title or office brings not the real reward. In its last analysis it is all summed up in five little words: "We profit as we serve."

Once again the principle of the inseparability of authority and responsibility has been demonstrated.

The New Shipping Board

The controversy in the national shipping board at Washington has brought out the fact that one of the world's greatest builders could not, with hands tied, proceed with the functioning of the business in hand. The West admires the dignified attitude taken by the former manager of the Emergency Fleet Corporation.

The new appointees, E. N. Hurley of Chicago, and Rear Admiral W. L. Capps, both splendid executives, meet with the sincere public approval and undoubtedly in the reorganization of the great work at hand the utmost care will be displayed in amply vesting proper authority where responsibility is placed.

New Legislation on Water Power

The particular attention of every reader of the Journal of Electricity is especially called to the contribution by John A. Britton, the much beloved dean of the electrical industry on the Pacific Coast, that appears on page 118 of this issue.

In this forceful contribution, Mr. Britton points out the salient features of the Walsh bill that is now before Congress which, if made into a law as a war emergency bill, will greatly relieve the present deplorable situation in the hydroelectric development of the West.

The editorial columns of the Journal of Electricity have frequently called the attention of its readers to this vital relief that must be had before renewed activity in hydroelectric development may reasonably be expected.

Forgetting all other considerations, however, except those of national stress under which the nation now finds itself the passage of this bill will mean much for national security.

Tersely put, it means in California alone, an immediate saving of approximately six million barrels of oil annually. Every pound of this oil possesses sufficient energy to project a human being into a skyward flight

of over eighteen miles. What would happen to the German army if such energies were properly focused?

The answer is easy, annihilation. And we are going to bring this answer into a reality by conserving our natural resources, which means the passage of the Walsh bill.

A Decision of Unusual Importance

In the economic struggle between the publicly owned and privately owned utility, it has long been observed by disinterested parties that an unfair advantage has often been taken by municipal authorities in furthering the aims of a municipal project in entering the field already served by a privately owned organization.

In former years such procedure often won applause even from staid citizens of the community. In modern times, however, under the remarkable system of public regulation of utility organization and the splendid response that has been made by these utilities throughout the West the picture presents an entirely different appearance. It is of more than passing importance to note recent court decisions that affect this issue.

In handing down a recent decision in the case of the Los Angeles Gas & Electric Corporation against the City of Los Angeles, Judge Bledsoe established a precedent beyond which municipally owned utilities cannot pass in their undue treatment of privately owned companies already operating in the same territory. Thus, he said:

"I am in entire harmony with a plan of municipal improvement such as has been projected in the City of Los Angeles, and as is here under consideration. I am, however, also firmly of the belief that until the city, by purchase, appeal to eminent domain or otherwise, has lawfully and properly and justly eliminated competition, it must meet its competitors as any other private agency would be compelled to meet them, and must stand with them in the same relation to the law, and let its success be measured by its ability satisfactorily to serve the public rather than by its power through the exertion of public functions to occupy a position of supremacy in the field which it deliberately has chosen to invade."

The Rewards of Convention Effort

Much has been said about the advisability of holding electrical gatherings during the coming season, so that today the conclusion is pretty clearly drawn by all clear thinkers that a getting together in times such as these is not only a matter of good policy or rather of putting the best foot forward but it is in fact a great necessity. If ever there exists a time for men to assemble and talk over problems of common interest in a great industry it is in times of national stress when the nation as a whole is calling for a maximum supply of power with minimum outlay of human effort and minimum consumption of fuel supply.

The recent Santa Cruz convention of the California Electrical Contractors' Association is a good instance of the rewards of convention effort. Hitherto this organization and its deliberations have represented but a single department or development in the work of the great electrical industry. But by gathering in representative manufacturers, manufacturers' agents, jobbers, central station men and others interested in the betterment of the electrical industry this convention really became the arena for a great feast of everything that goes toward betterment of the industry.

The particularly striking feature was the spirit of candid expression of the problems that are holding up possible harmony between contractor dealer, jobber, manufacturer and central station and the evident spirit of willingness on the part of all to harmonize these activities. While it is true that the convention is now past and in the heat of business getting many of these ideals will be soon lost sight of, still the seed is sown; and it is bound to bear fruit in better and bigger business because of this very beginning in a clear spirit of co-operation so synonymous with the spirit of the great West.

Such, then, are the rewards of convention effort and it may indeed be said to repay in such instances as that at Santa Cruz an hundred fold.

An Interesting Commission Hearing

The case of the Pacific Electro Metals Company in Central California against the Pacific Gas & Electric Company, the Great Western Power Company and the Sierra & San Francisco Power Company is one of unusual interest.

The Electro Metals Company is a newly organized industrial plant situated near Bay Point, California, that is installing two 3000 kw. furnaces and three 300 kw. furnaces for the manufacture of ferro silicon products. The company has an immediate need of 10,000 h.p. and in the near future will probably require from 20,000 to 30,000 h.p. This company is endeavoring to secure a rate of $15 per horsepower per annum for electric energy from the defendant companies, all of which contend that such a rate would be below the actual cost of service.

The hearing before the California Commission has brought out the point that under the existing contract between the Pacific Gas & Electric Company and the Great Western Power Company, the former corporation produces a minimum of 15,000 kw. at a 70 per cent load factor from the latter company at an agreed price of 5½ mils pr kw.-hr. On the other hand the monthly power bill of the new company will probably approximate $30,000.

John A. Britton, vice-president and general manager of the Pacific Gas & Electric Company, testified that at the present time it is impossible for his company, under existing contracts, to furnish such a quantity of power and furthermore he stated that none of the existing companies were in a position to furnish the required power.

The entrance of electro-chemical companies into the industrial life of the West has long been heralded as splendid institutions for the industrial growth of this section of the country. The Electro Metals Company is the first of its kind in North America, west of Toronto, Canada. Its entrance finds a dilemma in power supply that could not possibly be met were

it not for a fortunate grouping in the near vicinity of three of the greatest hydroelectric companies in the United States. So fast has the present industrial needs of the West grown of late that even these giant institutions will find it difficult to spare the desired power.

As to the outcome of the hearing set for August 7, it is difficult to speculate. The entire problem is one of unusual importance. The rate that will be set by the commission and its orders of service upon the various hydroelectric companies serving the community are being looked forward to with unusual interest.

Electro Chemical Development on Pacific Coast

The entrance of electro-chemical industries into the industrial life of the West means much for the continued growth and commercial activity of this section of the country.

Like other pioneer industries that have come westward, this new development must carve new fields of usefulness and must make for itself new destinies in the growth of the great Pacific area.

The very fact that 7500 tons of ferro-silicon products were manufactured last year at Welland, Ontario, and shipped over a costly routing to Vancouver, British Columbia, to be there shipped to Vladivostok, the great Russian seaport of the Pacific, indicates in a measure some of the possibilities of the future for such industries when located in the West.

The vast natural resources of chemical products in the mountain lakes and of rare metals in the bowels of the mineral districts of this section offer a flattering future for the investor.

It is, however, well recognized that hydroelectric energy must be employed to bring about this development to its highest economic degree of usefulness.

The old basis of the kilowatt hour under which power companies have been disposing of industrial loads must be somewhat harmonized with the kilowatt year or horsepower year basis of measurement before these industries can have a fair chance of economic existence.

The entire problem is one of great importance to the power companies of the West, for in its scientific solution they will be forwarded in commercial development by acquiring very desirable steady loads, at the same time the countless secondary industries that must perforce be called into life by the production of these electro-chemical products on the Pacific Coast means much for new diversified loads of many kinds.

Utility Activity in the Far East

According to the United States commerce reports, many interesting phases of utility life are transpiring among our Pacific neighbors. The pleasing financial status of certain of the utility companies on the eastern coast of Asia comes as a great source of satisfaction to engineers throughout the West, since the passage of each month serves to find the engineering and commercial ties of all countries bordering the great Pacific cemented into a closer and more friendly relationship.

A public service corporation rarely is able, as the result of a year's business, to declare a dividend of thirty per cent on its capital stock, place one-sixth of the amount of its paid up capital to increase its reserves, write off its plant account more than one-third of the amount of its capital stock, and be compelled to call upon its patrons, the public, not to use its product so freely. Nevertheless this is the record of the Hongkong Electric Company (Ltd.), which supplies electric light and power for the principal portions of the colony as distinct from another concern which serves Kowloon and the mainland of the colony.

Such an instance as this but shows the ever-growing financial stability of the oriental trade in affairs electrical and it comes as a pleasing feature and pleasant augury of still closer engineering and commercial ties for the future.

THE NEW JOURNAL SERVICE: With an ever increasing desire to meet the present day needs of men of the electrical industry in the West, there is inaugurated in this issue a department that bids fair to prove of inestimable value to readers of the Journal of Electricity.

John A. Britton, vice-president and general manager of the Pacific Gas & Electric Company, has contributed the first article in a series of problems and solutions that will occupy a department in each issue of the Journal of Electricity. Other prominent men of the industry have signified their willingness to assist in this great work of briefly expressing their views on perplexing problems that may be asked for solution through this department.

In the issue of August 15, 1917, an extensive article on the application of electricity and steam generation in the great Inspiration Copper Company's plant in Arizona will appear. New economic factors have here been developed and this article is not only of intense interest but of great practical importance to men of the industry in the great mining communities of the West.

Conclusions on heat insulating materials will also appear in the issue of August 15, 1917. This subject is one of immense interest throughout the West, due to the growing use of electricity in the heating of water and Mr. Crawford, the author of this series, speaks from the experience of an expert in the heat insulating lines.

Other new ideas are in the planning to make the Journal of Electricity speak to the men of the electrical industry of a great nation through the engineers of the West, who are from all quarters assisting in this great work.

PERSONALS

Fred L. Webster, manager of the California offices of the Allis-Chalmers Company, has left for the East, where he is to have charge of the main office of his company, which is located at Chicago. This promotion comes as a beautiful recognition of the long and effective work of Mr. Webster throughout the West.

As a pioneer in sawmill e'ectrification, he fought many valiant battles for the advance of the electrical industry, and today has to his credit a record of thirty sawmills that he has brought to the method of operation electrical.

In addition to this brilliant achievement there must be given to Mr. Webster the credit of the introduction of the steam turbine as a prime mover in sawmills on the Pacific Coast; the sale of a 2500 kw. motor-generator set to the Pacific Gas & Electric Company, the sale of 4250 k.v.a., 130,000 volt transformers to the Pacific Gas & Electric Company Drum development; 150,000 volt transformers to the Southern Sierras Power Company, 22-800 h.p. Corliss engines for the General Pipe Line and the Valley Pipe Line; the motor installation to drive California Street Cable Railroad; the introduction of the Diesel engine to operate oil pumping machinery through Sanderson & Porter for the Yarhola Pipe Line Company of which he installed 15 complete units of each. He also placed the sale of the hydraulic development in connection with the Pacific Light & Power Company and the Pacific Gas & Electric Company.

Detail notation of Mr. Webster's biography are as follows: Born: Yarmouth, Nova Scotia, 1869. Training: Burrell Johnson Iron Works machinist apprentice, 1886-1890. Engineering experience since completion of training: Williams Engine Works, Beloit, Wis., assistant foreman of machine shop in charge of all erecting and assembling engines 1890 to 1892; E. P. Allis, Milwaukee, erecting power plants 1892-1896; Consolidated Goldfields Company, Johannesburg, South Africa, construction work in connection with the Simmer & Jack Gold Mining Company, and other mines, 1896-1901; St. Louis Transit Company, assistant superintendent of power in charge of all power plants, machine shops and equipment, 1901-1904; Fulton Iron Works, St. Louis, Mo., manager of sales Chicago office, 1904-1906; Allis-Chalmers Manufacturing Company, salesman Chicago office 1906-1907; manager Seattle and Portland offices, 1907-1912; manager California offices, 1912-1917.

Mr. Webster is a member of the American Society of Mechanical Engineers. The heartiest good wishes of engineers and men of the electrical industry throughout the West go with him in his new field of endeavor.

Paul Lebenbaum, electrical engineer for the Portland division of the Southern Pacific Company is a recent San Francisco visitor.

J. A. Groninger, assistant chief electrician of the Santa Fe, with headquarters at San Bernardino, Cal., is a recent San Francisco visitor.

A. C. Cornell, formerly of the St. Louis sales organization of the Western Electric Company, has been made sales manager of the Denver office of the company.

George Scarf, a consulting engineer of Nevada City, and formerly superintendent of the Nevada district of the Pacific Gas & Electric Company, is a San Francisco visitor.

J. A. Cranston, district manager, General Electric Company, for Oregon and Washington with headquarters at Portland, spent three days in Seattle recently on company business.

H. R. Noack, in charge of the hardware and insulator department of the Pacific States Electric Company, has returned to San Francisco after an extended trip through the Northwest.

W. D. Donan has succeeded **C. A. Malone** as purchasing agent of the California-Oregon Power Company, Mr. Malone having answered the call to service as a captain in the coast artillery.

H. K. Fish, formerly associated with the Western Electric Company at Los Angeles, has recently assumed charge of the electrical department, San Francisco office, Fairbanks, Morse & Company.

Robert E. Rae, for many years with the Western Electric Company and for the last four years sales manager for Stanley & Patterson of New York City, has resigned from the latter concern.

Charles A. Rolfe, president of the Southwestern Home Telephone Company of Redlands, is in San Francisco representing the interests of his company before a hearing of the Railroad Commission.

Paul C. Van Zandt, cement expert of the Allis-Chalmers Manufacturing Company, arrived from Japan on the "Shinyo Maru" after a successful business trip. He was met in San Francisco by Mrs. Van Zandt and son.

F. S. Schuyler, of the San Francisco office of Allis-Chalmers Company, has been left temporarily in charge of the office since Mr. Webster's promotion to the Chicago office until his permanent successor has been appointed.

Samuel A. Chase, assistant to the manager of the supply department of the Westinghouse Electric & Manufacturing Company of East Pittsburgh, is visiting all coast points and making many friends among men of the electrical industry.

H. A. Cleary, assistant city engineer of San Francisco, and **A. E. Chandler,** of the California Water Commission, recently returned from a tour of inspection of the work of the city of San Francisco now under way upon the Hetch Hetchy project.

H. A. Lemmon, of the Truckee River General Electric Company at Reno, Nevada, after a brief visit at San Francisco and Santa Cruz where he delivered one of the most helpful papers at the recent convention of the California Electrical Contractors' Association has returned again to his home city.

Walter S. Van Winkle, formerly with the Great Western Power Company, is now manager of the Bay Point Light & Power Company of Bay Point and purchasing agent for the Pacific Electro Metals Company, which is installing two 3000 kw. furnaces and three 300 kw. furnaces at Bay Point for the manufacture of ferro-silicon products.

P. F. Apfel, president of the Electric Sales Corporation at Seattle, recently returned from a business trip covering the greater portion of the State of Idaho and while away secured a contract from the school board at Paul, Idaho, for installation of Apfel's system of electric heating in the new high school at approximately three thousand dollars.

Henry G. Bradlee, member of the firm of Stone & Webster and **Frederick S. Pratt,** chairman of the board of directors, arrived recently in Seattle from Boston. This is the first trip of Mr. Bradlee for more than five years, while Mr. Pratt has returned for an inspection of the Stone & Webster properties in the northwest after an absence of six months.

M. M. O'Shaughnessy, city engineer of San Francisco, was the recipient of a host of congratulations on July 14 by the citizens of San Francisco when the beautiful new four million dollar Twin Peaks tunnel was thrown open to the public for

the first time. The unusual construction features of this work were described in the Journal of Electricity, June 15, 1917.

Percy H. Pitts, industrial engineer for the Pacific Gas & Electric Company, after motoring with his wife to the Santa Cruz convention of the California Electrical Contractors' Association, returned to his home in Oakland just long enough to get a few hours' rest before starting on a two weeks' vacation trip by automobile to the Big Meadows Dam of the Great Western Power Company.

H. R. Judah, assistant general passenger agent of the Southern Pacific Company at San Francisco, has retired from active service after forty-five years of telling effort. Mr. Judah's inherent courtesy and tact have long been recognized by the engineering fraternity of the West and they wish him the joy and peace befitting the contemplation of a life of service for the public well done.

George H. Harries, for years prominent as a public utility executive, has received a leave of absence from the various corporations with which he is connected in order to resume military service. He is now in command of the Nebraska National Guard, at Fort Crook, having been commissioned brigadier general. General Harries since 1912 has been a vice-president of H. M. Byllesby & Company.

R. L. Cardiff, local manager at Santa Cruz for the Coast Counties Gas & Electric Company, was host at a delightful box party at the Casino after the banquet of the California Electrical Contractors' Association. Among his guests were **Tracy Bibbins,** president Pacific States Electric Company; **R. M. Alvord,** manager supply department General Electric Company's San Francisco office; **D. E. Harris,** vice-president Pacific States Electric Company; **Frank Fagan,** Western manager lamp department, General Electric Company; **Stanley Walton,** commercial department Pacific Gas & Electric Company; **F. H. Thrall,** of Roberts Manufacturing Company, and **Robert Sibley,** editor Journal of Electricity.

MEETING NOTICES FOR ELECTRICAL MEN

Activities Pacific Coast Section N. E. L. A.

Plans are being perfected for a special car of central station men, manufacturers, jobbers and dealers in California, Nevada, Arizona and New Mexico who will attend the convention of the N. W. Electric Light & Power Association at Spokane, Wash., Sept. 12-15. Any electrical man contemplating a trip through the Northwest at this time will be welcome. The car will go directly to the convention by a route yet to be determined. The return trip can be made as desired, stop over privileges being provided on the fare-and-a-third plan. Further information can be obtained from the Secretary Pacific Coast Section N. E. L. A., Mission street, San Francisco.

All members of the Pacific Coast Section N. E. L. A. who are in the service of any branch of the army or navy, or who are engaged in civilian work for any branch of the government due to the war, are requested to notify the secretary of the association promptly in order that a complete record may be kept of the services rendered to the government by the Section membership.

A complete roster of members and committees of the section will be published and distributed in the near future. The appointment of the following committees has already been announced by President H. F. Jackson:

Membership Committee

W. L. McKinley, Chairman, Sierra & S. F. Power Co., S. F.
H. S. Batchelder, Western States Gas & Elec. Co., Stockton.
R. E. Frickey, Northern Cal. Power Co., Redding.
W. S. Leffler, Great Western Power Company, San Francisco.
W. H. Talbot, San Diego Gas & Electric Co., San Diego.
H. N. Sessions, So. Cal. Edison Co., Los Angeles.
H. P. Pitts, Pacific Gas & Elec. Co., San Francisco.
C. F. Butte, Butte Engineering & Elec. Co., San Francisco.
J. M. Buswell, San Joaquin Light & Power Co., Fresno.
C. A. Kelley, Southern Sierras Power Co., Riverside.
Edward C. Russell, Tucson Gas. Elec. Lt. & P. Co., Tucson, Ariz.
J. B. Mechling, Nevada-Cal. Power Co., Goldfield, Nev.
C. B. Hall, Illinois Electric Co., Los Angeles.
J. R. Buchanan, Silver City Power Co., Silver City, N. M.
E. F. Sells, Albuquerque Elec. Lt. & P. Co., Albuquerque, N. M.
Paul V. Quick, Landers, Frary & Clark, San Francisco.
B. G. McBride, Elko-Lamoille Power Co., Elko, Nev.
R. S. Arthur, Douglas Trac. & Light Co., Douglas, Ariz.
J. C. Rendler, So. Cal. Electric Co., Los Angeles.
J. E. Cornell, The Arizona Power Co., Prescott, Ariz.
A. E. Youngholm, Elec. Ry. & Mfrs. Supply Co., San Francisco.
H. E. Sanderson, Bryant Electric Co., San Francisco.
A. B. Day, Los Angeles Gas & Elec. Co., Los Angeles
J. O. Case, General Electric Co., Los Angeles.
Robert Sibley, Journal of Electricity, San Francisco.

Commercial Committee

S. V. Walton, Chairman, Pacific Gas & Elec. Co., San Francisco.
J. B. Black, Great Western Power Co., San Francisco.
H. A. Lemmon, Truckee River General Electric Co., Reno, Nev.
E. B. Walthall, San Joaquin, Lt. & Power Corp., Fresno.
E. B. Criddle, Southern Sierras Power Co., Riverside.
G. B. McLean, Southern California Edison Co., Los Angeles.
A. E. Holloway, San Diego, Cons. Gas & Elec. Co., San Diego.
C. M. Einhart, Roswell Gas & Elec. Co., Roswell, N. M.
R. M. Alvord, General Electric Co., San Francisco.
Miles L. Steel, Benjamin Electric Mfg. Co., San Francisco.
W. S. Berry, Western Electric Co., San Francisco.
M. L. Scobey, Home Electrical, San Francisco.
H. L. Aller, Pacific Gas & Electric Co., Phoenix.
H. J. Kister, Los Angeles Gas & Electric Co., Los Angeles.

Engineering Committee

J. E. Woodbridge, Chairman, Sierra & S. F. Pr. Co., San Francisco.
J. P. Jollyman, Pacific Gas & Electric Co., San Francisco.
J. A. Koontz, Great Western Power Co., San Francisco.
J. A. Shepard, Deming Ice & Electric Co., Deming, N. M.
J. G. Scrugham, Elko-Lamoille Power Co., Elko, Nev.
E. A. Quinn, San Joaquin Light & Power Corp., Fresno.
H. A. Barre, Southern Cal. Edison Co., Los Angeles.
L. M. Klauber, San Diego Cons., Gas & Elec. Co., San Diego.
C. O. Poole, Southern Sierras Power Co., Riverside.
W. C. Hornberger, Pacific Gas & Elec. Co., Phoenix.
S. J. Lisberger, Pacific Gas & Electric Co., San Francisco
E. R. Cunningham, Southern California Edison Co., Los Angeles.
E. R. Northmore, Los Angeles Gas & Electric Co., Los Angeles.

American Electro-Chemical Society Meeting

The thirty-second general meeting of the American Electro-Chemical Society will be held in Pittsburgh October 3d to 6th. A special feature of the meeting will be a series of papers and discussions on Electro-Chemical War Supplies, and the part the electro-chemical industry will play in the present struggle.

The committee in charge is outlining an elaborate plan of technical sessions, visits to industrial plants, and entertainment features. It invites the delegates to arrive in Pittsburgh on Wednesday, October 2d, so as to get together informally and enjoy some recreations which have been planned for them.

American Association of Engineers

For nearly two years the American Association of Engineers has tested the rendering of service to technical engineers through The Service Clearing House. This department was established solely to place technical engineers in touch with employers. A record of qualifications is maintained through which employers may be introduced to men who in their opinion, possess desirable qualifications. The average number of men placed in touch with vacancies has approximated 100 per month during the past two years. For this service, not one cent commission was charged, the membership dues defrayed all expenses. The association now proposes to broaden the scope of activity by offering to the business men and men in public office services of placing them in touch with competent consulting engineers to carry out any work of an engineering nature. Frequently municipalities desire engineering information, but they are at loss where to get in touch with consulting engineers in whom they may have full confidence.

A TRIBUTE TO A PIONEER ENGINEER

Squire V. Mooney, president John A. Roebling's Sons Co. of California, was recently given a pleasant surprise by many of his business associates on the occasion of his sixty-ninth birthday. Flowers, telegrams of congratulations and personal good wishes for the future were the means adopted to express the kindly feelings of his host of friends. As this year also commences the fortieth year of his services with the company, the two accompanying pictures, one when he assumed his duties as sole western agent in 1879, the other taken at his desk on his natal day, are of particular interest. Coming to California across Central America in 1863, Mr. Mooney was soon attracted to Nevada where his native ability shortly made him assistant superintendent of the famous Comstock mine. With the closing of that producer in 1878

S. V. MOONEY, PRESIDENT JOHN A. ROEBLINGS' SONS CO. OF CALIFORNIA

he became agent for John A. Roebling's Sons Co. at Virginia City. Since that time he has been continually with this company, of whose California corporation he is now president. In this period he has been closely associated with the construction of many of the great engineering developments of the West. He is one of the pioneers to whom the younger generation do honor, as the type of men who have helped to build the new West.

This age of progress too seldom pauses to think of those brave spirits who laid the foundation upon which the present superstructure has been reared. The pioneer, literally "one who serves," has ever gone before to prepare the way for others. He is the forerunner of progress, for whose highways his footsteps were the first surveys. He dared the deserts and made them blossom with the rose, he surmounted the mountains, and wrested from them their treasures of metal, he swam the streams and harnessed their turbulence. He is the courier of civilization, overriding precedent and ridding of the impossible by doing it. He plays the game at the outposts of empire and enjoys the playing, slave of the wanderlust but master of nature dust. He is the ambassador of evolution, the leader in science and industry and the benefactor of his race. Onward and upward is his course, ever willing to lend a hand, to start the new and mend the old. His deeds honor his name even if men do not.

The sentiment that recalls our obligations to these men is of the highest order. What a pleasure it is to pay this well-deserved tribute while the subject is with us, as executive head of the organization he has builded!

LATEST IN EVERYTHING ELECTRICAL

(A new type of radiant heater, a recent improvement in reverse current devices, and an advance in elevator control constitute the briefs on latest in everything electrical that we wish to call to the attention of our readers in this issue. There will also be found in this department an extensive review of new bulletins that should be carefully perused as from it may be gleaned the very latest and best ideas in new apparatus and devices that will greatly advance the electrical industry in the coming season. —The Editor.)

A NEW TYPE OF HEATER

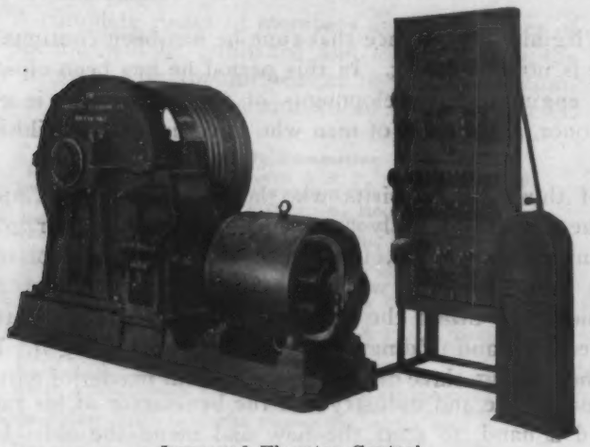
The new type of Hotpoint Radiant Heater, just perfected, is substantially constructed of pressed steel on the principal of a portable lamp and is of very attractive design. The reflector has a triple coat of copper plating very highly polished, the back being finished in black enamel, the base and upright in highly polished nickel. The reflector is fastened to the upright by a hinge joint and is adjustable, permitting the heat rays to be directed parallel to the floor or diagonally upward.

The New Radiator for Baths and Offices

The heating element core is made of composition material, the resistance wire being first wound into a small coil about the size of the Radiant Grill coil and then wound around the core one inch in diameter, thus giving a large amount of resistance material in a small space. The coil will run at normal temperature of about 1200 degrees which insures long life and satisfactory service. This particular pattern is especially adapted for small rooms, bath rooms, nurseries and offices during chilly mornings and evenings of fall and spring before cold weather installations are in operation.

NEW ELEVATOR CONTROL EQUIPMENT

The controller, elevator machine and motor for one of the two electric elevators recently installed in the new Willys-Overland Service Station, Tenth avenue and Fifty-seventh street, New York City, are shown in the accompanying illustration. The elevators are of the moderately high speed (400 ft. per min.) passenger type while the machine is of the single gear "V" groove traction construction. The elevator machines and equipment were built and erected by the Haughton Elevator and Machine Company of Toledo and the controllers designed and made by the Cutler-Hammer Manufacturing Company of Milwaukee.

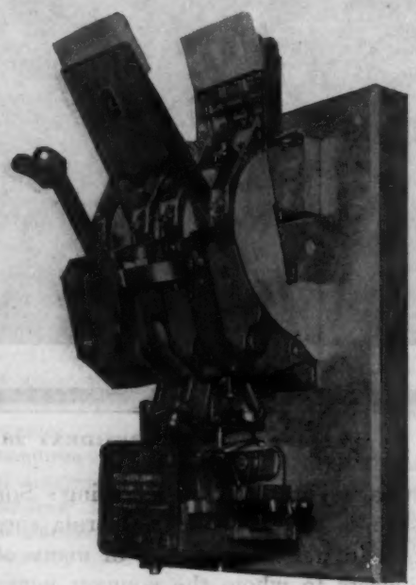


Improved Elevator Control

The magnetic three-speed elevator controllers used in the installation govern the reversal and speed control of the motors. They permit no more current to the motor than is necessary to hoist the maximum load, thus protecting the motor against injury due to excessive currents. The car in its travel is always under the full control of the operator. When it approaches the top and bottom limits, however, it is automatically slowed down and smoothly brought to rest.

CARBON CIRCUIT-BREAKERS

The new reverse current devices on the hand operated breakers of the Westinghouse design are of the polarized mechanical relay type which has proven more accurate and reliable than the solenoid type. As there is no necessity for electrical contact, these reverse current devices are considered preferable to the separate form of electrical relay operating through shunt coils.



A New Carbon Circuit Breaker

CIVIL SERVICE EXAMINATION

The United States Civil Service Commission announces open competitive examinations for master gage expert, gage inspector, and assistant gage inspector, for men only. Vacancies in the Bureau of Standards, Department of Commerce, for duty in Washington, D. C., and in the field, and in positions requiring similar qualifications, will be filled from these examinations.

The compensation for these positions are as follows: Master Gage Expert, $2000-$3500 a year; Gage Inspector, $1800-$2400 a year; Assistant Gage Inspector, $1000-$1600 a year.

REVIEW OF RECENT BULLETINS

Electric Lighting

The engineering department of the National Lamp Works of the General Electric Company has just issued a helpful booklet on store lighting which contains a discussion of various types of lighting systems with suggestions and tables of particular application in store lighting problems.

The Gardner Electric Manufacturing Company, represented by the Bay Point Electrical Supply Company of Bay Point, Cal., have issued a circular describing the Gardner remote control switch, a simple device for the operation of small street lighting systems, interior lights and small motors.

The engineering department of the National Lamp Works of the General Electric Company has just issued bulletin 28 which deals with show-window lighting, presenting in a general way the essentials of good show-window lighting, emphasizing especially the possibilities of light, direction and color.

Electrical Apparatus and Specialties

The Sprague Electric Works of the General Electric Company has issued bulletin 48923 on electric hoists of from one to six tons, Type W.

A large gear shift folder has recently been issued by The Cutler-Hammer Manufacturing Company entitled "What the Motor Car Distributers Are Doing."

Transmission line insulators for all voltages are discussed at length in a beautiful new illustrated one hundred and six page catalog by The R. Thomas & Sons Company.

Solenoid brakes for a.c. and d.c. motors, and self starters for single-phase induction motors are treated in leaflets of the General Electric Company, Nos. 68010 and 68408 respectively.

The General Electric Company has just issued a bulletin 48900 on "CR-9510 Automatic Solenoid Brakes and CR-9500 Solenoids." Some very interesting data is contained in this thirty-two page bulletin.

"The High Tension Disc Insulator" has recently been published by the Jeffery-Dewitt Company of Detroit, Mich. Power men interested in high tension insulators will find much of interest in reading its contents.

The General Electric Company has just issued a bulletin 46029 on "High Capacity Portable Wattmeter." This instrument as described in the bulletin, is of the dynamometer type, and is very similar in design to the standard type P-3 wattmeters.

"Benjamin Trouble Savers" is the subject of a folder being supplied to central stations for their imprint and distribution by the Benjamin Electric Manufacturing Company. It graphically illustrates the use of Benjamin attachment plugs, two-way plugs and current taps in the home and office.

"Electrical Specialties" is the title of a beautifully illustrated, one hundred twenty-five page catalogue just issued by Harvey Hubbell, Inc., of Bridgeport, Conn. A unique feature that will be of unusual interest to the trade is the chart method made use of in dealing with lamp sockets and other electrical specialties.

Bulletin 44424 has just been issued by the General Electric Company on "GE-203-P Ventilated Commutating Pole Railway Motor." The GE-203-P railway motor is an improved form of the GE-203 motor which has earned a high reputation for satisfactory operation, and of which there are now several thousands in use.

Bulletin 46028, describing the "Temperature Indicator," is being distributed by the General Electric Company. The Temperature Indicator equipment, as explained, affords a convenient and rapid means of indicating continuously, at the switchboard, the temperature of various portions of the windings of electrical machinery under operating conditions.

The General Electric Company is distributing supplementary sheets for bulletin 47100 on safety first, truck type, alternating current switchboard panel units; bulletin 47474 on Type F Form K 21 oil circuit breakers; bulletin 47475 on Type F Form K 26 oil circuit breakers; bulletin 47476 on Type F Form K 22 oil circuit breakers for outdoor service; and Type F Form K 026 oil circuit breakers for outdoor service.

"Westinghouse Electrical Equipment for Ventilating Service" is the title of an unusually attractive, profusely illustrated pamphlet just issued by the Westinghouse Electric & Manufacturing Company (Motor Application Circular 7193) The question of ventilating equipment for various buildings is briefly described in a non-tchnical manner, and the characteristics of both the alternating and direct current motors for this service are given in some detail.

Electric Ranges and Appliances

A new folder entitled "A Self Seller" descriptive of the new No. 1 Western Electric iron has made its appearance to the trade.

The revised list of inspected electrical appliances of date April, 1917, prepared by the Underwriters' Laboratories, is now on distribution.

Care and operation of a Hughes Electric Range is the title of a fourteen page booklet just issued by the Hughes Electric Heating Company.

The Hotpoint Electric Heating Company is distributing literature entitled "hotpointers" which will be effective in promoting a bigger than ever heater business in the fall campaign.

"What Every Kitchen Needs" is the title of an interesting and valuable booklet published by the Hughes Electric Heating Company of Chicago. The booklet contains forty-eight pages of electric cooking recipes by Alice Bradley, principal of Miss Farmer's School of Cookery of Boston.

An attractive catalogue on Hotpoint Tableware setting forth percolators, grills, toasters, chafing dishes, teakettles and teapots all electrically operated, has just been issued by the Hotpoint Electric Heating Company. The folio is twenty-four by eighteen inches in size and contains twelve pages of beautifully engraved matter.

A copy of the new catalogue No. 39 of Globe electric ranges and heating devices, is being sent to the trade. This electric range catalogue is compiled with completeness and contains a great fund of information. The illustrations, the descriptions of the various stoves and the little sales talks are quite out of the ordinary.

Up-building of Electrical Industry

Organizing and conducting safety work in mines are effectively treated in technical paper 103 just issued by the Bureau of Mines.

"Water Resources of the State of Oregon" is the subject matter of Bulletin 4 just issued from the office of the State Engineer, Salem, Oregon.

"Important Books on Electricity" is the title of a recent pamphlet of the D. Van Nostrand Company, which sets for the books on the subject either published or imported by that publishing house.

The Jovian Central Office has issued for free distribution a comprehensive brochure completely covering every phase of the accident and health insurance the order is now furnishing its members. The booklet is written by Mercury Ell C. Bennett, and is entitled "Smack—in the Bull's-Eye.

The Society for Electrical Development, Inc., has just issued "House Wiring Publicity Helps" which is a most attractive pamphlet of twenty-eight pages replete with hints and illustrative aids for the house wiring campaign that is now receiving nation-wide attention.

Two new publications by the National Electric Light Association are interesting and helpful. "Electricity in Your Home," aids in securing new business from homes as yet not wired, and "The Comforts and Conveniences of Electricity in Your Home," when placed in the hands of home builders, architects, building constructors, electrical contractors, etc., materially assists in providing adequate electrical equipment at the time the home is built.

Mechanical Apparatus

"Blystone" is the title of a thirty-six page pamphlet on concrete mixers just published by the Bystone Manufacturing Company of Cambridge Springs, Penn.

Scientific Advance

Motor gasoline, its properties, laboratory methods of testing, and practical specifications is the matter dealt with in technical paper 166 of the Bureau of Mines.

The Abstract of the Census of Manufactures has just been issued by the Bureau of the Census. This inquiry, which related to the calendar year 1914, was made in 1915, and the primary or fundamental data derived from it, together with some details as to kinds and quantities of the various classes of products, were issued some time ago in the form of several series of press summaries which were published, in whole or in part, in many newspapers and periodicals. The abstract presents, in convenient form, with an alphabetical index, all the information that will be needed by the great majority of persons who have use for the manufactures statistics.

Miscellaneous

The Southern Pacific Company has issued an interesting booklet entitled "Outing Resorts" that should find a welcome place by all seeking vacation outing in California.

The General Electric Company has just issued leaflets on the individual vehicle taper charging set with automatic panel, the Tungse rectifier, and small battery charging outfits.

The city of Seattle has issued a one hundred sixteen page booklet of specifications for a complete hydroelectric plant in the description of the proposed extension to the municipal electric light and power system of that city.

UTILITY COMMISSION NOTES

California Commission Notes

The California Railroad Commission recently determined to institute an investigation into the rates, rules and regulations of the jitney and auto truck lines subject to its jurisdiction.

It is the purpose of the commission at these hearings to secure information and suggestions from the auto bus men and all interested parties, upon which the commission may formulate rules for the operation of these carriers. These rules, when established, will cover such matters as quality of service, time schedules, filing of bonds, etc. In order that all parties may be represented, the commission has sent notices to all jitney and auto truck operators subject to its jurisdiction, and to all railroads, boards of supervisors and city councils.

Utilities Commission of Idaho

In the matter of the application of the Idaho Power Company for a certificate of convenience and necessity relative to the village of Kimberly, Twin Falls County, Idaho, the commission has granted the request.

In the matter of the application of the Idaho Power Company for a certificate of convenience and necessity relative to the village of Hollister, Twin Falls County, Idaho, it is ordered that the certificate be granted.

In the matter of A. P. McRae, John F. Murphy, J. B. Cox, county commissioners of the County of Shoshone, State of Idaho, and Tamarack and Custer Consolidated Mining Company, a corporation, complainants, versus The Washington Water Power Company, a corporation, defendant, the action has been dismissed.

In the matter of the application of C. N. Friday for a certificate of public convenience and necessity to construct, maintain and operate an electric light and power system for the village of Dubois, and the communities known as Spencer, Idaho, in the County of Fremont, and Camas, Idaho, in the County of Jefferson, State of Idaho, the commission has granted the request.

ALUMINUM LIGHTNING ARRESTERS

A twenty-four page bulletin No. 45601-A is being distributed by the General Electric Company on "Aluminum Lightning Arresters for Alternating Current Circuits." This bulletin supersedes Bulletin No. 45601, and contains valuable data and diagrams on this installation.

The General Electric Company claims that the aluminum type of lightning arrester is superior in protective qualities to any other. It owes these qualities chiefly to the "Valve" action of the aluminum cell which has the property of opposing the flow of current, like a high resistance, at the normal operating voltage, and of allowing a free flow at abnormal voltages due to lightning or similar disturbances. A close analogy to this action is found in the safety valve of the steam boiler, by which steam is confined until the pressure rises above a certain value, when it is released.

HEADLIGHTS AND TURBO-GENERATORS FOR STEAM LOCOMOTIVES

The General Electric Company has just prepared for distribution, bulletin No. 42,014 entitled "Headlights and Turbo-Generators for Steam Locomotives." To meet the rigid requirements of locomotive headlight service, the General Electric Company has designed a turbo-generator set distinctly novel in its construction and representing the most advanced development in this class of apparatus along practical lines. Three years of exhaustive service tests and a knowledge accumulated from a vast amount of experience in turbine manufacture have resulted in the building of these turbines with the smallest number of parts consistent with the requirements of good design, durability, efficiency and close regulation.

The headlight supplied with the turbo-generator consists of an 18-inch silver plated, copper reflector, equipped with a simple focusing device mounted on a suitable table and enclosed in a steel casing of standard design. The reflector has a 2¼ inch focal length which is sufficiently long for accurate focusing of the largest headlight lamps.

BOOK REVIEWS

The Nelson Form for Choosing Bidders and Awarding Contracts. By H. W. Nelson of Moline, Illinois, and for sale at Technical Book Shop, San Francisco. Size 4 by 5 in.; 84 pp.; paper binding. Price 50c.

The author of this booklet is president of Moline Heat Co. of Moline, Illinois, and has for over twenty years been closely allied with electrical contracting. Twelve years' experience in the engineering profession has carried him to almost every part of this country.

The booklet contains a working plan for properly filling out bids and offers a method of procedure. At the Santa Cruz convention of the California Electrical Contractors Association, July 11-14, 1917, W. S. Berry, Western salesmanager of the Western Electric Company ,highly recommended its use among electrical contractors and told of its helpful application in a number of Eastern centers.

TRADE NOTES

Eastern Announcements of Office and Management

The Smith Perry Electric Company of Dallas, Texas, is announced as distributor throughout Texas and Oklahoma for electric ranges and heating devices manufactured by the Globe Stove & Range Company of Kokomo, Indiana.

The Wagner Electric Manufacturing Company, of St. Louis, announces the appointment of F. T. Coup, formerly connected with its Chicago office, to take charge of its Milwaukee office, in its new location, the First National Bank Building.

Announcement has just been made by the Westinghouse Electric & Manufacturing Company that it has been awarded the contract for furnishing the electrical equipment for the new Pennsylvania hotel now being erected at Seventh avenue and Thirty-third street, New York City.

New Business—Seattle District

Sanderson & Porter, engineers, New York, have made final arrangements for their shipyard at Raymond, Washington.

The Classen Chemical Company of Port Hadlock, Washington, are making improvements and increasing their facilities for the manufacture of sulphurous acid.

The De Laval Steam Turbine Company, William T. Pulten, manager, formerly of the Geo. B. Adair Company, have opened their new offices in the L. C. Smith building, Seattle.

The Washington Pulp & Paper Company, Port Angeles, Washington, are rapidly making headway on their new paper and pulp mills located on Ediz Hook at Port Angeles, Washington.

The Wheeler-Osgood Company, Tacoma, have just completed their new 150 ft. by 8 ft. Alphons Custodis Chimney Construction Company radial brick stack for their new power house at their Tacoma mills.

The Olympia Light & Power Company, L. B. Faulkner, manager, expect to have their new 2000 horsepower high tension substation at Tumwater Falls in operation shortly, power being supplied from the transmission system of the Stone & Webster lines from Tacoma.

The American District Telegraph Company, installers and operators of central station fire alarms, supervisary watchman service, supervisary sprinkler alarms and burglar alarms, have been endeavoring to secure a franchise from the Seattle council to operate in the city of Seattle.

The Hallidie Machinery Company, Seattle, R. E. Lunkley, manager, Northwestern agents for the Ridgeway Dynamo & Engine Company, are furnishing a 1250 k.v.a. Ridgeway-Rateau steam turbine and alternator unit for the new power plant of the Wheeler-Osgood Company, Tacoma, Washington.

The Wheeler-Osgood Company of Tacoma is to equip its mill with electrical machinery which will increase its capacity from 150,000 to 170,000 feet per day. Four 465-horsepower turbines, three boilers, one generator and one turbine will be purchased at once. The improvements at the mill will cost a total of $60,000.

The old blast furnace and smelter plant of the Oregon Iron & Steel Company, occupying five acres of land along the Willamette River at Oswego, were purchased outright recently by William Pigott of Seattle, head of the Pacific Coast Steel Company interests in this section, with the prospect that it will be placed in shape within about 60 days for the manufacture of pig iron.

Puget Sound Sawmills & Shingle Company recently placed in operation its mill at South Bellingham. The mill has been practically rebuilt and will be electrically driven. A 1250 k.v.a. Allis-Chalmers steam turbine unit and 50 motors made by the same company were installed. The plant is now in operation and the results obtained from the new equipment are very satisfactory.

Gray & Barash Company, Incorporated, First avenue South and Jackson street, Seattle, electrical engineers and contractors, have leased a site comprising a block at Horton avenue and Colorado street in the South canal waterway addition and will erect a plant covering the entire block. Extensive orders for electrical machinery and equipment for the numerous ships under construction and proposed has led to the taking of this step in order to better handle the business.

The Standard Electric Company, 316 First avenue South, Seattle, organized the latter part of 1916 by Herbert C. Moss, has been very active since its organization. It will shortly start work on the electrification of the Spokane avenue bridge for the city; is building a $3000 switchboard for the naval torpedo station at Keyport near Bremerton and is installing the entire electrical equipment for the plant of the National Engineering Company under construction at South Park, Seattle.

NePage, McKenny Company, with headquarters at Seattle and with offices in the chief Pacific coast cities, report business active. A contract was recently closed for the complete electrical equipment in the Oregon-Washington dock, Seattle. The San Francisco office reports the signing up of a contract for the complete electrical equipment in the women's dormitory building at Stanford University, amounting to about $25,000; the company has the contract for similar work in the Judson Iron Works at Oakland approximating $30,000 and is doing work for the Chevrolet Motor Company in Oakland amounting to $60,000. The Portland office reports important contracts for electrical work in new ships.

New Business—Portland District

Since the $6,000,000 bonding act for road purposes has carried, the State Highway Department of Oregon has been flooded with applications for positions, not only from points in Oregon, Washington, California and Idaho, but the eastern states as well.

The West Coast Engineering Company and the J. C. English Company, both of Portland, Oregon, were the electrical contractors and the fixture contractors, respectively, for the beautiful new building of the First National Bank of Portland, described under "Banking Institutions Doing-it-Electrically" in the issue of the Journal of Electricity for July 1, 1917.

The Silver Falls Timber Company of Silverton, Oregon, has started its new mill. This is entirely electrically driven, the prime mover being a 1250 k.v.a. horizontal Allis-Chalmers steam turbine. The sawmill and planing mill are equipped throughout with Allis-Chalmers motors. The sawmill machinery was built by the Allis-Chalmers Manufacturing Company.

New Business—Los Angeles District

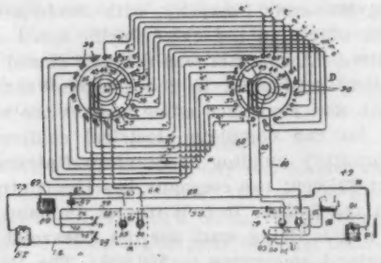
The San Diego Consolidated Gas & Electric Company, which is a prominent subsidiary of Standard Gas & Electric Company, has received authority from the California Railroad Commission to contract with the Southern California Edison Company for a supply of hydroelectric power to supply the total demands on its distributing system and a 100 per cent increase in future business. The contract will be for a period of 20 years and will enable the San Diego Company to practically close down its 16,000 horsepower steam plant, which uses oil for fuel, and hold the steam plant as a reserve. The Southern California Edison Company will build a duplicate transmission line from Santa Ana south to connect with the transmission system of the San Diego Company at San uan Capistrano.

WHAT WESTERN INVENTORS ARE DOING

(The electric stove has long been recognized as a possible means for profitably marketing huge quantities of electrical energy throughout the West. Below may be found an interesting brief of a new device for an electric stove which has just been patented by the Hotpoint Electric Company at Ontario, California. Four other devices, the inventors of which are men in the West, are also briefed in the following lines. These consist of an elevator signaling system, a ship-building form, a steam whistle signaling device, and an electric signaling device for automobiles.—The Editor.)

1,231,033. **Elevator Signaling System.** Walter A. Loomis, Los Angeles, Cal.

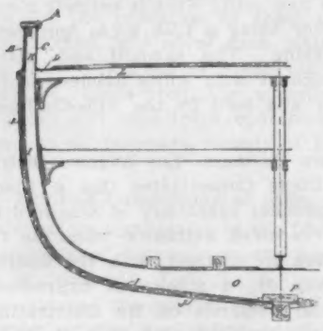
An elevator signaling system, the combination with independently operable elevator cars adapted to run at predetermined relative positions, of electrical signaling means in each car, a normally open circuit for and common to said signaling means, and means to close the circuit for the signaling means of the cars when the latter move out of their predetermined relative positions, comprising a series of correspondingly arranged contacts for each car, rotatable contact members for each series, the corresponding contact



members of said series being connected with one another electrically, said rotatable contacts being normally engaged with non-corresponding contacts of said series, and means for rotating the rotatable contacts synchronously when the cars are running at their predetermined relative positions whereby when one car moves out of its predetermined position relative to the other the rotatable contacts thereof will touch contacts of its series which correspond to the contacts of the other series and the circuit for the signaling means will be closed.

1,231,232. **Shipbuilding.** Fred A. Ballin, Portland, Ore.

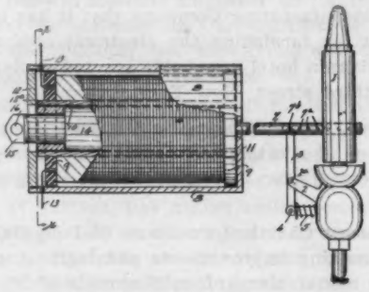
A wooden ship, a metal bulwark plate above the main deck line that forms a member of a top chord of a truss,



diagonally disposed planking and wooden frame sections that form the sheer members of the truss and means for joining the several parts together with the bulwark plates exposed.

1,231,179. **Signaling Device.** James P. McBride, Seattle, Wash., assignor to Carl M. Lovsted, Seattle, Wash.

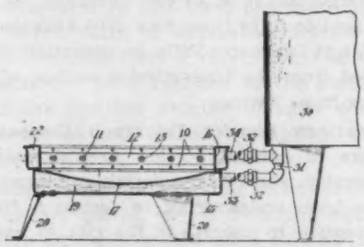
A solenoid operated steam whistle having a valve controlling lever, the combination of a perforated extension bar one end of which is integral with the core of the solenoid,



adjustable hole and pin connection means between the bar and the whistle lever, whereby the solenoid and whistle may be adjusted as to relative position.

1,231,196. **Radiant-Type Stove.** William A. Rankin and Henry D. Laraway, Ontario, Cal., assignors to Hotpoint Electric Heating Company, Ontario, Cal., a corporation of California.

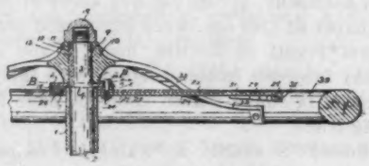
An electric heating device, comprising an electric heating element, a reflector placed near the heating element,



walls forming an inclosed chamber adjacent to said reflector, walls forming an inclosed chamber around the walls of the device, a body of cooling fluid in said chambers, a reservoir, and means for connecting the interior of said chambers wth said reservoir.

1,230,957. **Electric Signaling Device for Automobiles.** George F. Voight, San Francisco, Cal.

A device of the kind described, including a disk-shaped supporting plate mounted upon the upper and reduced end



of the steering wheel shaft and above the upper end of the standard, an outstanding flexible contact lever supported by the supporting plate,

NEW ELECTRICAL DEVELOPMENTS

(Electro-chemical demands for power in Central California, that bid well to absorb the greatest single load thus far furnished one company in industrial uses, constitute the most important new electrical development of the past semi-monthly period. Reference is made to this new load on the editorial page of this issue. Other items of new electrical development throughout the West may be gleaned from the following lines.—The Editor.)

FINANCIAL

SAN FRANCISCO, CAL.—Receiver John P. Coughlin of the Northern Electric Railway has issued the following statement of earnings for the fiscal year closing June 30, 1917, compared with the same period last year:

	1917	Increase
Gross earnings	$920,206.00	$102,772.88
Operating expenses	724,155.88	3,903.48
	$196,050.12	$ 98,869.40
Taxes	$ 44,532.60	784.31
	$151,517.52	$ 98,085.09

MESA, ARIZ.—The town council has received two bids for the gas and electric bonds. One through the Mesa City Bank at par, less $3700 expense; the other through the Salt River Valley Bank at par, less $3000 expense. The council may readvertise for bids.

SONORA, CAL.—An ordinance was read for the first time for a special election to be held for the purpose of submitting to the qualified electors of Sonora, a proposition to incur a bonded indebtedness to pay the cost of municipal light and power works, consisting of an electrical destributing and street lighting system. It was laid over for second reading.

LOS ANGELES, CAL.—The public service commission has set aside from municipal power revenues for the month of June the sum of $50,000 to be placed in the city treasury for payment of interest and sinking fund on all issues of power bonds. This makes $100,000 that has thus been set aside by the commission for this purpose, in compliance with its announced policy of making monthly appropriations for the payment of all interest.

REDDING, CAL.—The Anderson-Cottonwood Irrigation District has sold $368,000 of 6 per cent bonds to the Anglo-London Paris Bank of San Francisco, at $96.69 and accrued interest. The same bank paid only $95.63 for $480,000 of the same bonds about a year ago. The higher price was realized today because the success of the district is assured. Water was turned into the main canal last Sunday and is as far south as Anderson. The latest sale will give the district all the money it will need for five or six years. It retains $207,000 of the bonds, which it may sell at any time.

INCORPORATIONS

WAUCONDA, WASH.—The Wauconda Telephone Company has been incorporated here.

WOLF POINT, MONT.—The Wolf Point Motor Company has been incorporated here.

WESTBY, MONT.—The Westby Telephone Company has been incorporated in this place.

GREY CLIFF, MONT.—The Bridger Creek Telephone Company has been incorporated in this city.

LOS ANGELES, CAL.—The Anderson Electric Company of California has been incorporated in this city.

SPOKANE, WASH.—Articles of incorporation have been filed in Olympia for the Northwest Power & Light Company with a capitalization of $200,000.

SALT LAKE CITY, UTAH.—The Buckle Electric Company has been incorporated in this city by J. V. Buckle, M. M. Allison, Mary E. Freck, Gladys Buckle and J. G. Larson.

AUBURN, CAL.—Articles of incorporation have been filed by J. W. Morgan and Daniel Kirby of Auburn and Dr. J. L. Rollins of Colfax for the incorporation of the Bear River Water & Power Company.

ILLUMINATION

BUTTE, MONT.—The Electrical Equipment Company (Inc.), has succeeded the Sullivan Electric Company.

MARIPOSA, CAL.—The San Joaquin Light & Power Company has been awarded a franchise to operate in this city.

VIRGINIA CITY, NEV.—The Nevada Valleys Power Company has filed an application for a lighting franchise in this city.

LEMOORE, CAL.—The Trustees have rejected all bids for the furnishing and installing of the proposed electrolier system.

WATTS, CAL.—The board of trustees of Watts accepted the bid of D. A. Tamplin at $2025 for a complete electric lighting system.

FULLERTON, CAL.—La Habra has decided to establish a lighting system. A petition has been submitted to the board of Supervisors.

DALY CITY, CAL.—County Clerk J. H. Nash is receiving bids for illumination with electricity of the public highways in the Visitacion district.

RIVERSIDE, CAL.—The common council of Riverside is receiving bids for an electric lighting system according to plans and specifications on file with the city engineer.

LODI, CAL.—Electroliers will be placed on East Lodi avenue. The committees have secured funds for the installation of the lights. A single globe type of electrolier has been endorsed. The base will be made of concrete.

ALBANY, ORE.—The city council acting as a committee of the whole relative to the matter of the acquisition of a water and electric plant by the city, presented an unfavorable report at a special caucus.

BOISE, IDAHO.—The Idaho Power Company has been given a certificate of public convenience and necessity by the public utilities commission for an electric light system in the town of Kimberly, Twin Falls County.

YUMA, ARIZ.—A franchise has been granted to E. F. Sanguinetti and F. L. Ewing for the erection and maintenance of a line of poles and wires for the transmission of electrical energy for light and power purposes along Gila street.

CORCORAN, CAL.—The San Joaquin Light & Power Corporation has a force of seven men at work installing the system of 29 1000-candle power street lights which are to be distributed throughout the residence and business section of Corcoran.

EVERETT, WASH.—The county commissioners have given the Washington Coast Utilities Company a franchise for constructing electric light and power lines through eight townships in the north end of the county, covering in all about 200 miles of line.

WILLIAMS, ARIZ.—F. A. Jones of Phoenix is conferring with an eastern capitalist who is interested in the Williams Electric Light & Water Company whose plant was burned, and the two will arrive at some plan whereby the

town can have electric lights at once. The loss will be in the neighborhood of $25,000.

HONOLULU, T. H.—Congress has appropriated the $80,000 authorized two years ago for lighting the entrance channel to Pearl Harbor. The appropriation is for lighting the entire entrance channel. Between 15 and 20 light stations will be built to replace the present system of light buoys. Next in order will be the drawing up of plans and specifications by Superintendent F. C. Palmer and Inspector Arledge. After these are approved by Washington bids will be advertised for.

TRANSMISSION

LOS ANGELES, CAL.—Sealed bids are being received by the board of public service commission for electric generator, equipment and transformer.

ELLENSBURG, WASH.—Heath & Gove, architects of Tacoma are receiving bids for the construction of a new power house at the State Normal School here.

GLENDALE, CAL.—The board of trustees are receiving bids for three-phase electrical current to be furnished the city to be used in operation of its electrical distributing system.

LOS ANGELES, CAL.—The Davidson Construction Company has been awarded the contract for building a power house in the rear of the new Coulter building. The cost will be $9960.

PORTLAND, ORE.—Bids are now being received by the Western Reduction Company for a transformer and power house building to be built in connection with a new industry to be established here.

RENO, NEV.—The Truckee River General Electric Company is to build a high tension power line from Verdi to the Poeville mining district and it is believed many mines will install electric plants.

MARTINEZ, CAL.—Ground has been broken at Bay Point for the erection of a new manufacturing plant for the manufacture of chemicals by an electrolysis process by the Pacific Electric Metal Company.

HAINES, ORE.—The flood of Rock Creek caused a damage to the Eastern Oregon Light & Power Company's flume and transmission line of approximately $3000 and it will take $500 to repair the broken dam at Killamacus Lake.

OROVILLE, CAL.—Development of the St. Francis mine at Klamath Peak upon a large scale is to proceed at once. Plans include the installation of a hydroelectric plant. Waters of the Sucker Run have been taken over by the Engel interests and will be used to develop power to operate the mines.

TACOMA, WASH.—The members of the city council will meet soon to discuss the advisability of purchasing the Hebb power site on the White River for the construction of a power plant for the city at an estimated cost of $1,000,000. The site is capable of generating 120,000 h.p., four times the capacity of the La Grande plant.

PALO ALTO, CAL.—One hundred thousand dollars is to be expended at Palo Alto by the United States for a 12-mile terminal belt railroad and about $60,000 for 2,000,000 ft. of lumber. Other needs will be 2,000,000 ft. of insulated wire, 16,000 ft. of lamp cord; 8000 key sockets, 9000 shades, 10,000 cleat receptacles, 8500 snap switches and other electrical equipment.

SAN FRANCISCO, CAL.—George S. De Sousa, traffic manager of the Marconi Wireless Telegraph Company, has transferred his headquarters from New York to this city, where he will be in charge of the entire Pacific Coast division of the Marconi Company. De Sousa arrived here several days ago and has taken charge of the company's traffic in the Insurance Exchange Building.

GRASS VALLEY, CAL.—Messrs. Dibble and Powers have been at Sierra City making arrangements to develop the Shamrock group of claims belonging to John Mansfield. A small electric plant will be put in at once to furnish power for machinery to drive the tunnel. It is the intention to push all work on the Shamrock, and the operators figure on spending at least $20,000 for development this summer.

RENO, NEV.—The Nevada Valleys Power Company, operating a plant at Lahontan and now furnishing power for Lovelock, Rochester, Packard and other districts in Humboldt County, is going to extend its lines into Washoe County. The company does not want to extend its lines into Virginia City, but wants permission to run the power line through one corner of Storey County in order to bring it to Washoe County from the Lahontan plant. The company does not intend to compete with the Truckee River General Electric Company, it is understood, but will buy power from it.

TRANSPORTATION

SANTA ANA, CAL.—The people of Tustin have voted to have the Pacific Electric Railway come into Tustin.

FULLERTON, CAL.—The Pacific Electric, instead of building into Fullerton, will start operations from this end before the end of next week.

PETALUMA, CAL.—The Petaluma-Santa Rosa Electric Railroad has awarded a contract to H. P. Vogensen of this city to erect a new depot of Mission design at Sebastopol.

SANTA ANA, CAL.—An ordinance has been adopted by the board of supervisors granting to the Pacific Electric Railway Company a franchise to construct and for 50 years to maintain an electric railroad along certain public roads and highways in the county of Orange.

LONG BEACH, CAL.—The city commissioners have given the Pacific Electric Railway Company permission to lay a single track standard gauge line on Water street, connecting with the main line and serving the Craig Shipbuilding Company and other industrial establishments.

ANTIOCH, CAL.—There is every indication that the Oakland-Antioch electric road will be extended from Pittsburg to Stockton through Antioch within a very few months, judging by the announcement made in the press dispatches that the Western Pacific was negotiating for the purchase of this line and the Northern Electric.

SANTA ANA, CAL.—The Pacific Electric Railroad Company has petitioned the board of supervisors for a five-year franchise from Santa Ana to Tustin, with a spur line to Burges new packing house on Lyon street. The line will be built along what is known as the Sixth street route. From Santa Ana the road will branch off the Huntington Beach line southeast of this city.

ASTORIA, ORE.—The Pacific Power & Light Company has awarded a contract for the reconstruction of a bridge for its car line in upper Astoria. Besides the bridge, the company will extend its terminals in upper Astoria one mile to reach the present city limits. Besides these improvements the Pacific Power & Light Company will spend $35,000 this year in other work here.

TELEPHONE AND TELEGRAPH

SUNNYSIDE, CAL.—The Sunnyside Telephone Company and the Valley Telephone Company have combined and will be known as the City Telephone Company.

HONOLULU, T. H.—The Mutual Telephone Company has taken out a building permit to erect an exchange in Kalihi on Kali street. The new building is to be constructed of concrete and to cost $15,000.

HEALDSBURG, CAL.—At a recent meeting of the board of trustees a motion was passed that the city attorney notify the California Light & Telephone Company that it is the intention of this city to advertise for sale a franchise for erecting poles and maintaining lines, etc., for telephone service in this city.

MESA, ARIZ.—District Manager P. C. Gettins and Construction Foreman Rohrig of the Mountain States Telephone Company have completed arrangements for the erection of the new exchange building for the Mesa telephone exchange. The new building will be of the standard type of Bell Telephone Company's exchange building construction, and be located at the corner of Main and Center, and will be of cream colored brick.

LOS ANGELES, CAL.—The Southern California Telephone Company, recently organized, has set aside $750,000 for connecting and consolidating the Pacific and Home systems in and around Los Angeles. About $250,000 will be expended for new switchboards, additions to existing switchboards and other apparatus; long distance systems, $14,000; installing and improving private branches, $30,000, and the remainder in consolidating the Pacific and Home exchanges at various points.

IRRIGATION

WILLOWS, CAL.—The board of supervisors has fixed Wednesday, August 5, as the date for holding the election on the organization of the Jacinto irrigation district, when it is believed the project will receive many more votes than the required two-thirds.

SAN DIMAS, CAL.—When the State Water Commission authorize the improvement, a group of San Dimas men will begin work on a $2,000,000 irrigation project, which will irrigate from 8000 to 10,000 acres of level land lying in the triangle formed by Pomona, San Dimas and Walnut.

SACRAMENTO, CAL.—The 8 inch electric pump of the Carmichael Colony Irrigation District has been started, and, with some adjustments, has been running more than a week. An abundance of water will be supplied in the colony. Delay was caused in starting by inability to get material from the manufacturers.

LODI, CAL.—E. M. Elliott and J. M. Posey of the new irrigation district, paid $6000 to the Stockton-Mokelumne Canal Company as the first payment on the irrigation plant which they expect to use as a nucleus around which they will form a Wright irrigation district. The district will consist of at least 12,000 acres, and possibly 20,000 acres.

MANTECA, CAL.—Roger Olmstead, one of the oldest engineers in point of service in the San Joaquin irrigation district is to be in charge of the construction of the Hilts' Sag flume above Oakdale. The big flume, which will be put up at a total cost between $150,000 and $200,000,is to consist of a reinforced concrete trestle 2200 feet in length and 70 feet high. It will support a box 15 feet wide and 10 feet in height.

LINDSAY, CAL.—It is now stated that there is little probability of securing water from the ditches of the Lindsay-Strathmore Irrigation System until about September 1. The company is being handicapped by lack of material and shortage of labor, while difficulty is being encountered at the old Merryman ditch, which is delaying work on the lower level line.

REDDING, CAL.—Water was turned into the main canal of the Anderson-Cottonwood irrigation district for the first time last week. The irrigation system will furnish water for 30,000 acres of land at a cost of less than $30 an acre. Farmers of the valley below are jubilant, though many of them will not reap the full benefit this season pending the putting in of headgates and opening up of laterals.

MANTECA, CAL.—To expedite the work of construction of the Hilt's sag flume, some steel forms for pouring concrete are to be purchased. The agreement drawn up by the attorneys for the Oakdale and South San Joaquin irrigation districts for the securing of water from the Sierra & San Francisco Power Company have reached the local office and will be taken up by the directors at their next meeting.

CHICO, CAL.—Work on the Paradise irrigation project is proceeding rapidly. Engineer Goodner has 75 men on the dam. Blasting for the spillway is now being done. Two miles of the main canal, which is being constructed under a separate contract, have been completed. W. H. Kraner, contractor for the distributing system, has a large ditching machine at work and several miles of trench for the pipes have been opened. The directors have asked the supervisors for permission to lay a pipe along the Paradise road, claiming the Wright law gives them this right. The matter is being looked into by District Attorney Leonard.

YUMA, ARIZ.—An application is on file for a franchise to place pipes on Gila and Willow streets for the purpose of running water to the Yuma mesa and irrigating about 17,000 acres of arid land. Also, an application to purchase a tract of land on the banks of the Colorado River north of the old prison cemetery, as a site for the installation of a 3000 h.p. pumping plant is on file. The name of the company which will carry the project through is the Yuma Mesa Irrigation Company. It is provided in the contract that the company will commence building the system not later than January, 1918, and have water ready for delivery not later than January 1, 1921.

BAKERSFIELD, CAL.—That an estimated flood of 1000 second feet of water from Kern River is going to waste in the overflow from Buena Vista Lake channel, beyond Lost Hills, is the report of a committee of citizens, comprising A. W. Thresher, Tipton Matthews, C. H. Brunton and J. F. Farraher, who made an investigation. They reported that a body of water 314 feet wide, and six feet deep, is flowing at the rate of 100 feet a minute, making a surplus of unused water in Kern County that would irrigate 50,000 acres to a depth of a foot in a month. They also estimated that the waste waters from Kern River, as shown by their investigation at the overflow, would irrigate 100,000 acres in addition to the 175,000 acres now under cultivation from Kern River.

AUBURN, CAL.—Articles of incorporation have been filed in the office of the Secretary of State for the organization of the Bear River Water & Light Company. The corporation was formed by members of the Erie Mining Company, who state that they are forming a public service corporation. The new corporation will build on the Bear River at a point on the old mining claim a dam that it is claimed will be nearly twice the size of the Lake Spaulding dam. A power house will be built at the dam. The water passing through the power house will be turned on the land below and used for irrigation purposes. The capital stock consists of 10,000 shares at $1 a share at par. Each member of the company has subscribed a dollar. The incorporators are J. W. Morgan and Daniel Kirby of Auburn and Dr. J. L. Rollins of Colfax.

BYRON, CAL.—There is a prospect of the early completion of the Byron-Bethany irrigation system, which will irrigate 15,000 acres of land. The project has been retarded owing to the fact that it was controlled by a private company, which could not condemn land for rights of way for the canal but it has been reorganized, and, as a public utility, has the rights of condemnation. The land is fertile, and it will make an important addition to the resources of eastern Contra Costa and western San Joaquin counties. On the Brentwood Irrigated Farms, which were brought under irrigation recently, there have been planted 1000 acres of sugar beets, 1000 acres of beans and 500 acres of alfalfa. This district has been under dry farming, one of the famous wheat sections of California, but from now on will be devoted to intensive culture. The land is being subdivided. Water is pumped from the San Joaquin River, and the whole system will embrace several thousand acres. Prospects are good in this county for a full crop of Bartlett pears, prunes, apples and peaches, 50 per cent crop of apricots and a 75 per cent crop of almonds. Numerous plantings of English walnuts are gradually coming into bearing. The crop promises 100 per cent this year.

ALPHABETICAL INDEX TO ADVERTISERS

The letter and number before each name are used in the classified page preceeding

A-1 **American Ever-Ready Works of National Carbon Co**
Los Angeles; 755 Folsom St., San Francisco; Seattle.

A-2 **Associated Engineering & Supply Co**..... 19
San Francisco, 840 Pacific Bldg., Los Angeles, Portland, Vancouver, B. C.

B-1 **Baker-Joslyn Company**..... 3
71-75 New Montgomery St., San Francisco; 911 Western Ave., Seattle; 353 Second St., Los Angeles.

C-1 **Century Electric Co**..... 16
906 So. Hope St., Los Angeles; 56 Natoma St., San Francisco; 65 Front St., Portland, Ore.

C-3 **Crocker-Wheeler Co**.....
87 New Montgomery St., San Francisco; 228 Central Avenue, Los Angeles.

C-5 **Crouse-Hinds Company**.....
Syracuse, N. Y., U. S. A.
New York, Boston, Cincinnati, Chicago.

C-4 **Cutler-Hammer Manufacturing Co**.....
579 Howard St., San Francisco; Morgan Bldg., Portland, Ore.; San Fernando Bldg., Los Angeles.

D-1 **Detroit Fuse & Manufacturing Co**..... 4
1404 Rivard Street, Detroit, Mich.

E-1 **Edison Lamp Works of General Electric Co**.....
Rialto Bldg., San Francisco; 724 So. Spring St., Los Angeles.

E-2 **Edison Storage Battery Supply Co**..... 15
206-8-10 First St., (near Howard), San Francisco.

E-3 **Electric Agencies Co**.....
279-283 Minna St., San Francisco; 419-421 E. Third St., Los Angeles.

E-4 **Electric Storage Battery Co**..... 11
1536 Bush St., San Francisco.

E-5 **Electric, Railway & Manufacturing Supply Co**..... 10
34 Second St., San Francisco.

E-6 **Electric Novelty Works**.....
533 Mission St., San Francisco.

E-7 **Economy Fuse & Mfg. Co**.....
Kinzie and Orleans Sts., Chicago.

F-3 **Federal Electric Company**..... 19
618 Mission St., San Francisco.

G-1 **General Electric Co**..... 17-18
724 So. Spring St., Los Angeles; Worcester Bldg., Portland; Rialto Bldg., San Francisco; Colman Bldg., Seattle; Paulsen Bldg., Spokane.

G-2 **Great Western Securities Corporation**.....
302-3-4 Hobart Bldg., San Francisco.

H-1 **Habirshaw Electric Cable Co., Inc**.....
(See Western Electric Company.)

H-2 **Hemingray Glass Co**..... 10
236-240 So. Los Angeles St., Los Angeles; 345 Oak St., Portland; 307 Mission St., San Francisco.

H-3 **Haller-Cunningham Electric Co**.....
428 Market St., San Francisco.

H-5 **Hotpoint Electric Heating Co**.....
Ontario, Cal.

H-4 **Hubbard & Co**..... 13
(See Pacific States Elec. Co.)

H-7 **Hurley Machine Co**.....
New York and Chicago. (See Pacific States Electric Co.)

I-2 **Illinois Electric Co**.....
261-263 So. Los Angeles St., Los Angeles.

I-3 **Interstate Electric Novelty Co**.....
111 New Montgomery St., San Francisco.

L-2 **Locke Insulator Manufacturing Co**..... 20
(See Pierson, Roeding & Co.)

M-3 **Moore & Co., Charles C**..... 19
Van Nuys Bldg., Los Angeles; Spalding Bldg., Portland; Kearns Bldg., Salt Lake City; Sheldon Bldg., San Francisco; Mutual Life Bldg., Seattle; Santa Rita Hotel Bldg., Tucson.

N-1 **Nason & Co., R. N**.....
151 Potrero Ave., San Francisco.

N-2 **National Conduit & Cable Co., The**.....
Trust and Savings Bldg., Los Angeles; Rialto Bldg., San Francisco.

N-3 **National Lamp Works of G. E. Co**..... 14
(All Jobbers.)

N-4 **New York Insulated Wire Co**..... 11
629 Howard St., San Francisco.

N-5 **Northwestern Pacific**.....
Ferry Bldg., San Francisco.

N-6 **National Carbon Co**.....
Cleveland, Ohio.

O-1 **Okonite Co. (The)**..... 20
(All Jobbers.)

P-2 **Pacific States Electric Co**..... 13
236-240 So. Los Angeles St., Los Angeles; 61-67 Fifth St. No., Portland; 200-210 Twelfth St., Oakland; 575 Mission St., San Francisco; 307 First Ave. So., Seattle.

P-5 **Pierson, Roeding & Co**..... 12
Pacific Electric Bldg., Los Angeles; Rialto Bldg., San Francisco; Colman Bldg., Seattle.

P-7 **Pittsburgh Piping & Equipment Co**..... 20
Monadnock Bldg., San Francisco.

S-4 **Southern Pacific Co**..... 2
Flood Bldg., San Francisco.

S-5 **Sprague Electric Works**..... 15
Rialto Bldg., San Francisco; Colman Bldg., Seattle; Corporation Bldg., Los Angeles; Electric Bldg., Portland; Paulsen Bldg., Spokane.

S-6 **Standard Underground Cable Co**..... 15
First National Bank Bldg., San Francisco; Hibernian Bldg., Los Angeles; Central Bldg., Seattle, Wash.; 815 Newhouse Bldg., Salt Lake City, Utah.

T-1 **Thomas & Co., R**..... 12
Pacific States Electric Co. and Western Electric Co., Pacific Coast Representatives.

T-2 **Tubular Woven Fabric Company**.....
Pawtucket, R. I.

U-1 **United Sheet Metal Works**.....
575 Howard St., San Francisco.

W-1 **Wagner Electric Manufacturing Company**..... 14
St. Louis, Mo.

W-2 **Western Electric Co**..... 16
Eighth and Santee Sts., Los Angeles; 1900 Telegraph Ave., Oakland, Cal.; 680 Folsom St., San Francisco; 907 First Ave., Seattle; 45 North Fifth St., Portland, Ore.

W-3 **Ward-Leonard Electric Co**..... 15
Mt. Vernon, New York.

W-4 **Westinghouse Electric & Manufacturing Co**..... 5-6
50-52 East Broadway, Butte; Van Nuys Bldg., Los Angeles; Couch Bldg., Portland; 212 So. W. Temple, Salt Lake City; First National Bank Bldg., San Francisco; Second and Cherry Sts., Seattle; Paulsen Bldg., Spokane.

W-6 **Westinghouse Lamp Co**.....
(See Westinghouse Electric & Manufacturing Co.)

W-8 **Western Pipe & Steel Co**.....
444 Market St., San Francisco; 1758 North Broadway, Los Angeles.

W-9 **Weston Electrical Instrument Co**..... 14
109 Weston Ave., Newark, N. J.; Frank E. Smith, 682 Mission St., San Francisco.

Y-1 **Youngstown Sheet & Tube Co**.....
Youngstown, Ohio.